ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

DECEMBER 1958

PRICE ONE DOLLAR

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Sewell by Moonlight" Courtesy, Kennecott Copper Corp.

Merry Christmas

New 4th manufacturing source of A-S-H pumps

The appointment of

Mars Machine Tool Manufacturing Co. Pty. Ltd.
Brisbane, Australia

as Licensed Manufacturer & Sales Representative
for Australia, New Zealand and adjacent areas

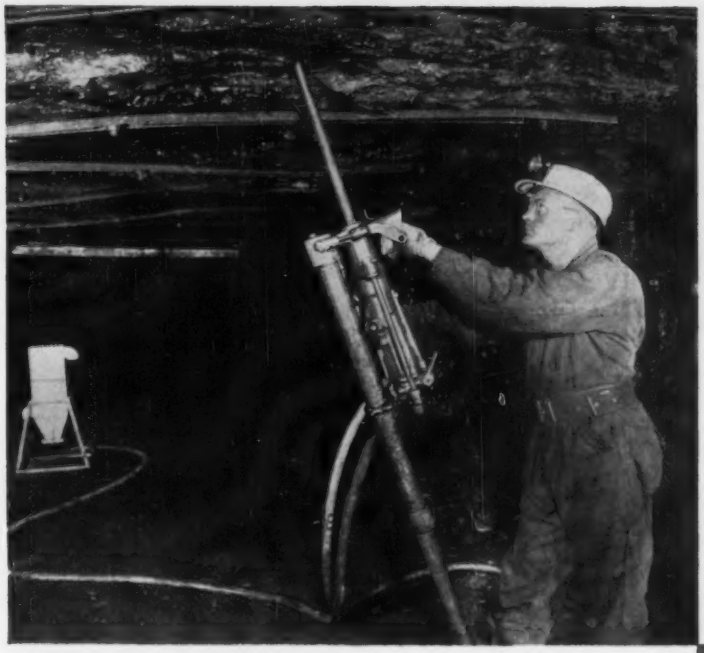
supplements the home plant at Hamburg, Pa., Morgardshammars Mek. Verstads Aktiebolag of Morgardshammar, Sweden, and Denver Machinery Co. Pty. Ltd., Johannesburg, South Africa.

World-wide distribution is facilitated by two branch offices, eight agencies with warehouse stock, and 25 representatives.

Wherever abrasives and corrosives are handled, the proper A-S-H pump is readily available—with applicatory engineering help—toward greater pumping efficiency and economy. Wherever you are, what is *your* pumping problem?

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL *and* **CENTRISEAL**
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED



new

from

Ingersoll-Rand

5-706 ♥ 11 Broadway, New York 4, N. Y.

It's the sensational

VACUJET ROOF BOLTING DUSTLESS STOPER

with built-in JET SUCTION
and PRESSURE DISCHARGE

In the new RP38E VACUJET dustless stoper, Ingersoll-Rand has perfected the first practical solution to the problem of dust control for roof bolting and other up-hole drilling operations. It's the *only* stoper that offers you all these important advantages.

Strong Suction Power — vacuum-producing jet ejector built into drill backhead. Can even drill horizontal holes!

Dust Discharged Under Pressure — to a distance of up to 25 ft from drill. Uses ordinary air hose.

Low-Cost Dust Collector — a simple filter and receptacle is all that's required. Even a canvas bag will do.

Quieter Operation — no unnecessary ear-splitting whine or howl in dust collection.

Highest Drilling Speed — because stronger vacuum and larger dust ports assure non-clogging operation.

Lower Bit, Rod and Shop Costs — tapered bit and rod connections eliminate need for furnaces, threading and forging equipment.

For the complete story on this revolutionary new VACUJET stoper, call your I-R man or send today for Bulletin No. 4195.

COMPRESSORS • CARSETS BITS • ALLOY RODS • HYDRA-BOOM JUMBOS
HOSE • JACKDRILLS • IMPACTOOLS

ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

DECEMBER 1958

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B.F.Goodrich

One belt does the work of 3 on high lift, long distance hauls

Oldest steel cord belt on Iron Range now in its 11th season

Problem: It's over a third of a mile and a 340-foot lift from the bottom of that iron ore mine up to railroad cars. Getting ore out of a deep pit like this used to take a series of three or more conveyor belts. No one belt could be strong enough for the job without being so heavy and stiff it would be impractical.

What was done: B.F.Goodrich engineers went to work on the problem, and developed steel cord construction. In this exclusive conveyor belt design, individual steel cords run lengthwise, each completely surrounded by rubber. These parallel cords give tremendous strength, yet are flexible so that troughing is natural, belt keeps centered on idlers, spillage is held to a minimum.

Savings: With steel cord construction, one conveyor belt now does the job of three or four belts on high lift, long distance installations. Money is saved, maintenance reduced, because the steel cord belt eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts.

Extra benefits: The B.F.Goodrich steel cord belt installed here has been at work 11 seasons now, hauling 1000 tons of ore an hour up and out of the pit. It has lasted longer than any conveyor belt ever made with steel cords or cables.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-484, Akron 18, Ohio.*

B.F.Goodrich *conveyor belts*

Behind the By-Lines...

Ye Christmas Greetings

Festoon the tree and hang the wreath,
Bring friends from hall and hill and heath
To sit with us. It's Christmastime
And, once again, we'll plait our rhyme.

Bring all the pleasures of this Yule
To Shattuck Denn and Tommy Newell,
To Walter Lawson at P-D,
To Margie and to Paul Bybee,
Jim Carne and Dr. Willard Libbey,
J. Bruce Clemmer, J. Payne Kibbe,
Al Scott, Jack Hall and Ware, T. M.,
Frank G. Woodruff and Georges Kremm.

Join us at the merry feast
Joel Eby, John H. East,
Fred DeVaney, Peter Flawn,
All our busy friends at Dawn,
Verne D. Johnston, Larry Roe,
Jack Monroe and Richard Moe,
Lyle Mulholland, Pierre Ledoux,
George M. Fowler and Wing Lew.

To Harry Marsh, our very best
To miners in L'Afrique d'Ouest,
To Pierce and Kirkland at Salt Lake,
All the season's greetings take.
To Kelloggs, Herb and Idaho
All our merry wishes go
And may the future days be passed in
Fun, for Roy Full and Mike Mastin.

Gather gifts, bring all you're able
To Elmer Jones and J. B. Knaebel,
Sherman White and Nelson White,
May their Christmas day be bright.
To Harold Olsen, bundles bring
To Carroll Weed, and Agnew, Wing
Dan'l Meschter, Langan Swent,
Who cares if St. Nick's back is bent?

For Rix Beals we'll wish there's never a
Better time; Add Bob Van Evera.
Robert Sohngen, share our hoard
Of fun! Let Dr. John C. Warde
Serve up a toddy hot with spice
For Norman Weiss and Julian Feiss,
For Roy F. Hollis, V. C. Wan-
sbrough, Frank N. Spencer, Victor Mann.

Noel to Edgar Sengier
And Jim Steel at Cartier,
Equally to Merrill Shoup
And to John D. Bradley's group.
Jacob, Myles, and Richardson, Jim,
Gordon Chambers, Philip Sim-
mons, R. B. Caples, Johnny Wise
Alec Jordan, Merle H. Guise.

Now let a modest cheer be heard
To those who labor with The Word:
To Peter Lowry, Julian Hayes,
(We make them miserable for days.)
To Merrill Phillips, Dutch Falkell
(Not only do they know—they'll tell!)
To Ballmer, Ward, and Brown, Miss Dore
(We needed facts—we got the story.)

Let reindeer dance upon the roof
Of Robert Palmer, Phil Malouf.
Merry Christmas, L. F. Pett.
Have we greeted Ross Leisk yet?
And Sid Goodwin, Gordon, Lou,
Gloyd M. Wiles and Franc R. Jou-
bin, Dave T. Steel, and Messel, Mike
Walter Nock and James A. Pike?

Gather 'round the bowl and stir well,
Frank M. Coolbaugh and Blair Burwell,
Let season's joy be unalloyed
For R. F. Goodwin and Jim Boyd,
For Wallace Woolf in the Coeur d'Alenes,
The Senator and all the Steens,
For J. L. Gillson, Wilmington,
The *Northern Miner's* Carrington.

A fond joyeux we now address
To all who write the mining press;
Come gather round the warming fire
With *Mining Record's* C. Newmeyer,
If thing's are fine, then make 'em finer
For A. J. Teske's *Wallace Miner,*
And bring a freshly-sharpened nib
For Bernick of the *Salt Lake Trib.*

The space is short, the meter's bad,
We're parting now, to view a glad
New Year. We hope it's crowded with
Good times—for you, your kin, and kith. —DPE

RIPPING DIGGING

This CAT No. 977 Traxcavator increased production 30%

Dixie Mines, Inc., one of the nation's largest producers of hi-grade mica, was using a competitive machine until last year in one of their mines. This mine, near Heflin, Alabama, is under the direct operating supervision of the firm of Bailey and Van Horn. Then a Caterpillar No. 977 Traxcavator with No. 6 Ripper was put to work. Result:

"By using the No. 977 we have upped our production 30%," says Joe W. Bailey, resident manager. "It loads faster, lifts faster and is mobile. Besides working the overburden and the mica bearing pegmatite, we use it to feed the mill at night, build dams, maintain roads and many other jobs. It's a good all-around machine—and we're happy with the freedom from down time and low cost of operation."

The No. 977 rips the tough pegmatite then loads it into trucks. During a ten-hour day, production averages 500 cu. yd. The material is put through a jaw crusher, washed and screened, leaving a concentrate of mica as residue.

The No. 977 works at such a money-making pace because it's built from the ground up as a loader-excavator, not just a tractor with bucket attached. About 26 sq. ft. of ground-gripping track provide tremendous traction to crowd the 2¼-yd. bucket full every time, get away fast.

In addition, operator comfort means that this fast pace is maintained. He has a high seat with excellent visibility of all bucket positions. Controls are easily reached—bucket control a one-hand operation.

Your Caterpillar Dealer has three sizes of Traxcavators in his line. Get the full story on them today. Have him demonstrate on your job. Count on him for fast service and quality Caterpillar parts.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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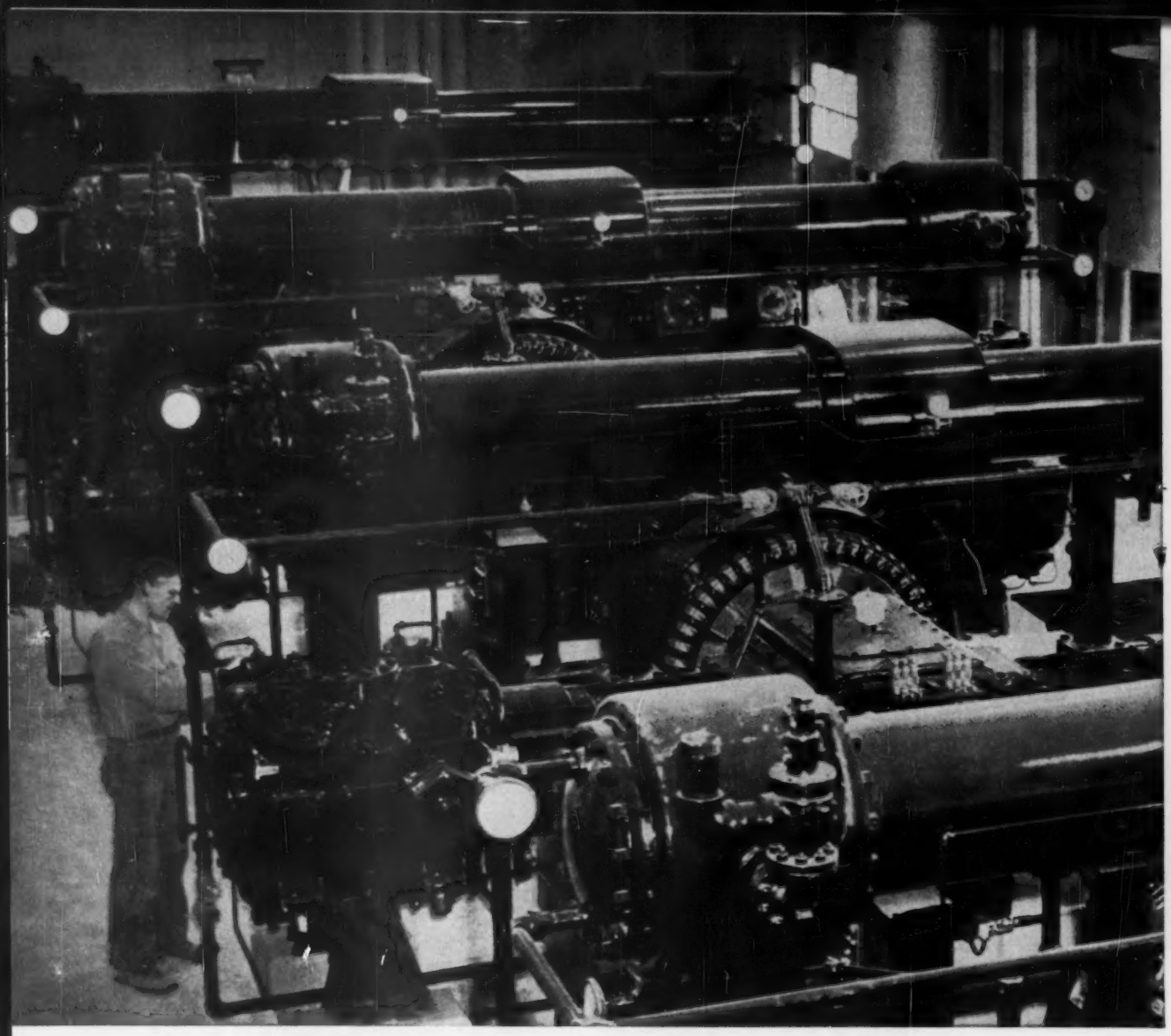
THE NO. 977—POWER AND VERSATILITY FOR MINING



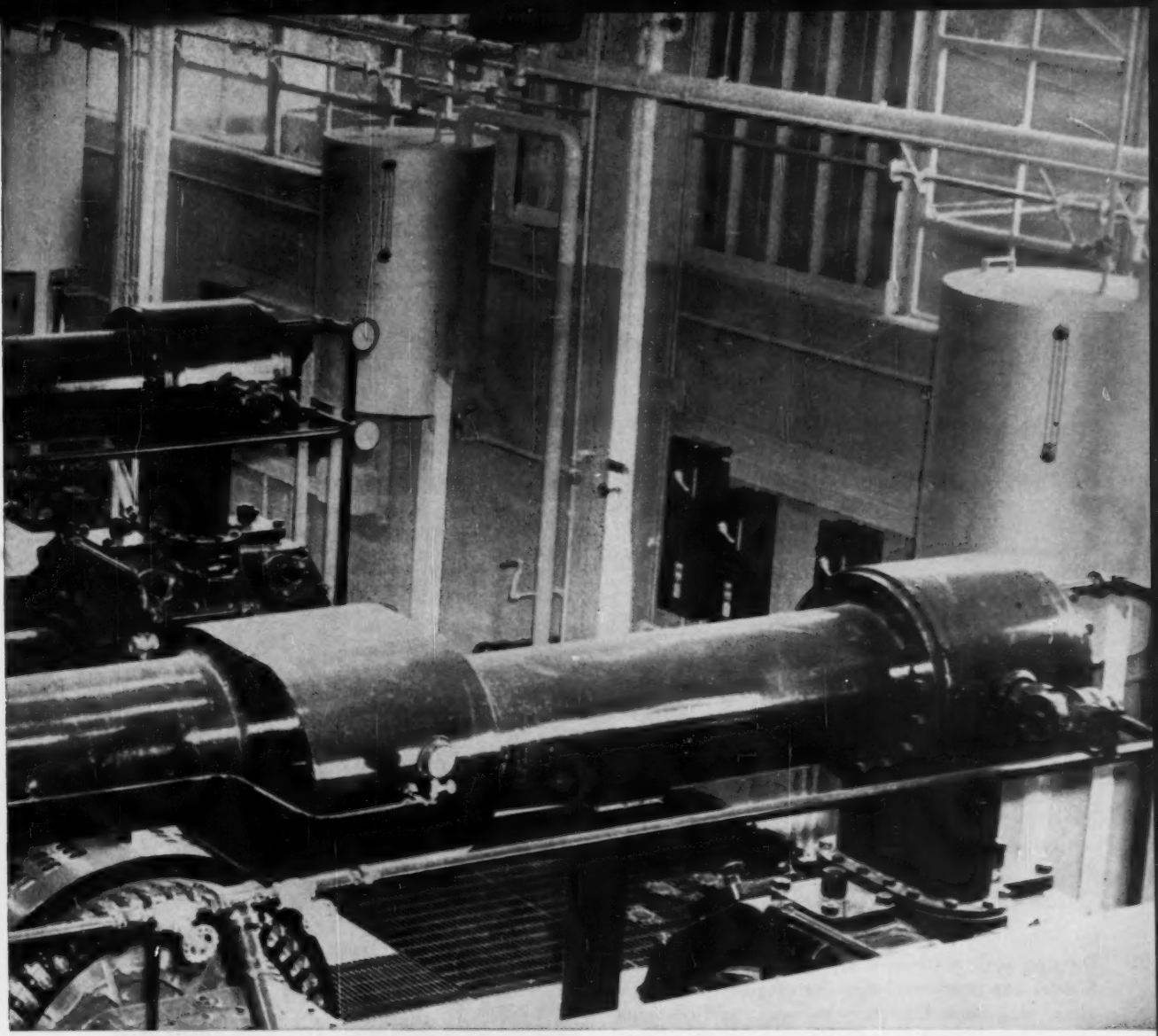
DON'T USE MORE OIL THAN YOU NEED TO

When an air compressor operator sees signs of wear, he often adds more oil and soon finds that over-lubrication is just as damaging. It causes excessive carbonization.

The answer to wear is not more oil but the *right* oil, Texaco Regal Oil R&O. First, it's a superior lubricant, second, its additives protect compressor systems against rust and oxidation, and keep systems clean, free from harmful deposits, assure top performance.

There is a complete line of Texaco Regal Oils R&O—including the right one for your compressors, regardless of type, size, pressure or operating conditions.

Let a Texaco representative show you how Texaco Regal Oil R&O can improve compressor performance. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



For more than twenty-five years more copper ore in the United States has been mined with Texaco-lubricated equipment than with any other.

TEXACO ROCK DRILL LUBRICANT EP protects your drills against wear when in use, against rust between shifts.

TUNE IN...Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

SMOOTH GOING IN ROUGH ROCK...

...with Lorain "Shear-Ball" on the job

This exclusive feature delivers a smooth, rock-steady swing. Over 60 hardened steel balls interlock two races to secure turntable to crawler. "Shear-Ball" eliminates center pin and nut, centering gudgeon, hook or top rollers and exposed roller path with their adjustment, lubrication and maintenance problems.

Digging rock is never easy, but this 1¼-yd. Lorain Shovel has many exclusive features that make it — along with other Lorains — the smoothest operating shovel you can put in rock. Here are a few:

"Shear-Ball" Mounting—This available, revolutionary turntable mounting is like a sealed "Ball Bearing." Eliminates forever all adjustment, maintenance and lubrication problems of old-fashioned roller designs. Turntable revolves freely and smoothly at full load. No downtime for servicing or adjustment means more rock moved per shift at lower cost.

Torque Converter—takes the shock and strain out of the hardest digging. Multiplies and adjusts engine torque to match digging demands. Engine can't stall regardless of load. There's more power at dipper teeth.

A telephone call to your Thew-Lorain Distributor will bring you all the facts on the Lorain Shovel best suited to your requirements. And ask him about the on-the-spot Lorain parts and service facilities that are such important plus values when you buy Lorain. See him soon.

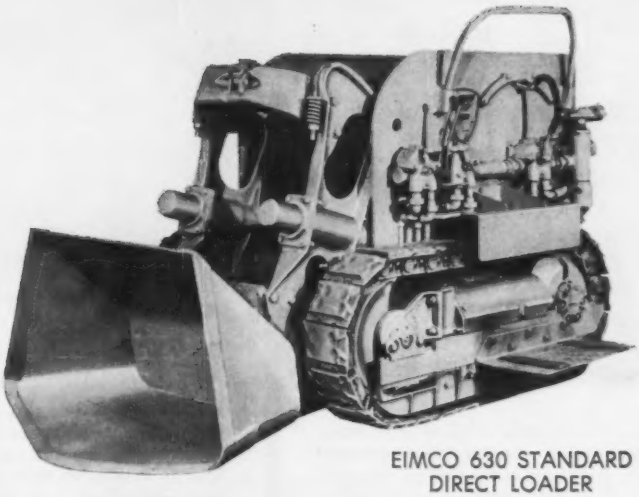
SMOOTH GOING for the operator with "Joy-Stick" Controls

Only 2 levers control all turntable operations through "Joy-Stick" air controls. Yet, all of the old-time "feel" of the machine is retained. There are fewer levers, fewer motions. This ease and simplicity of operation helps your operator produce more with less effort, less fatigue. Full "Air-Ease" Power Control of crawler travel, steering and tread-travel lock also are provided.

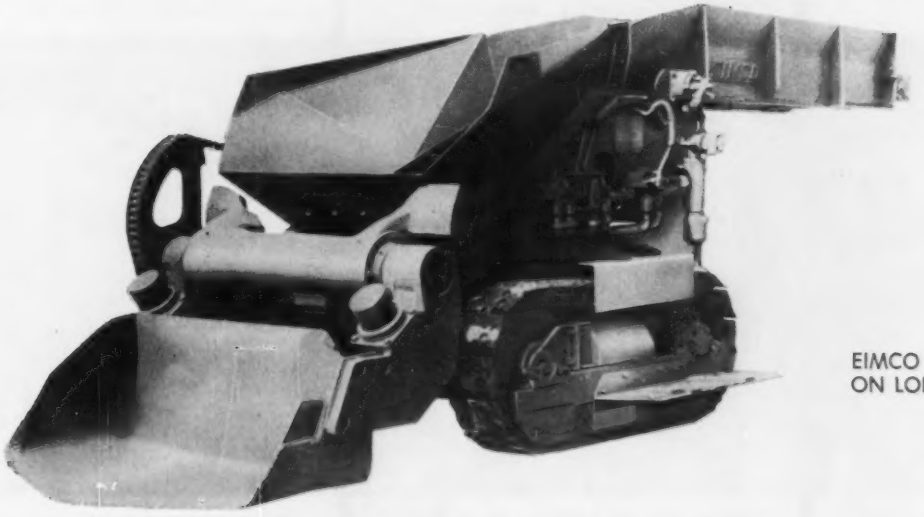
THE THEW SHOVEL CO., LORAIN, OHIO

THEW LORAIN®
RELIABILITY IN ACTION

TWO WAYS TO CUT LOADING COSTS



EIMCO 630 STANDARD
DIRECT LOADER



EIMCO 635 LOW HEADROOM
ON LONG CARS AND TRUCKS

We ask that when you consider underground loading equipment, you keep in mind the qualifications which only Eimco has — to give you, for any condition, the best machine for the job.

Eimco is not only the pioneer in the design and building of wheel and trackless mine loading machines, but it is also the oldest and the largest manufacturer in this field.

Your money can always buy a copy, but it will never work as hard or give you as much as when it's invested in a genuine Eimco machine.

The combination of Eimco's experienced engineering; its big, integrated world-wide manufacturing facilities; and its famous reputation for heavy, rugged construction make real and certain the claim — "You can't beat an Eimco."

THE EIMCO CORPORATION • SALT LAKE CITY, UTAH

EXPORT OFFICE, 51-52 SOUTH STREET, NEW YORK, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

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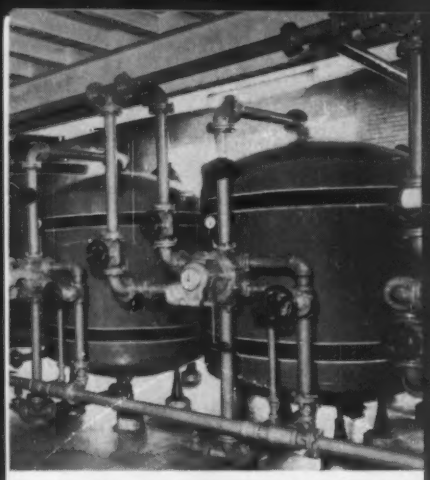
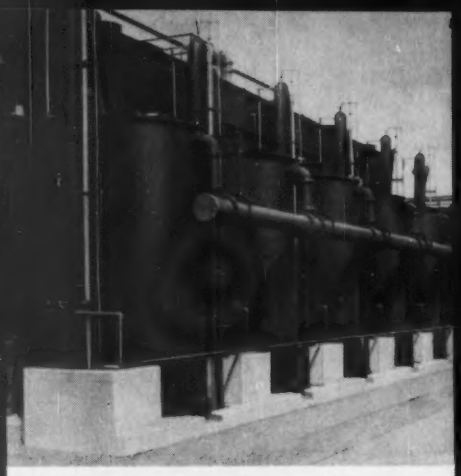


Pressure filters save on pumping, deliver effluent under pressure. Sand or Anthrafilt media for regular requirements. Neutralite filters for control of pH. *Carbo-Dur* for removing taste, odor. Bulletin 2225

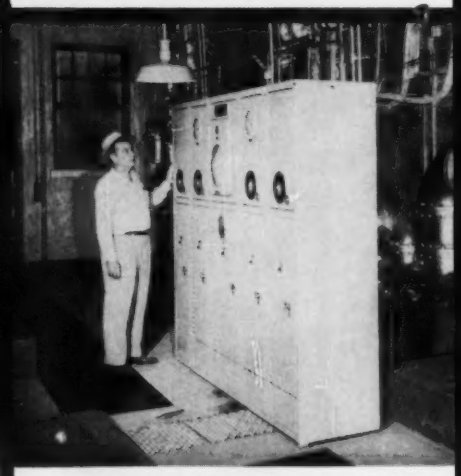


Automatic Valveless Filters cost less than manually-operated gravity units. Greatly reduce operating and maintenance costs. Use no expensive valves, no pumps, no rate controllers . . . yet operate completely automatically! Bulletin 4351

Zeolite water softeners remove all hardness, reduce iron and manganese. Easy to operate, low salt consumption. Pressure or gravity units or batteries—any capacity. Fully automatic controls to cut operator's time. Bulletin 2386

Automatic hardness tester insures maximum softening runs . . . and uniformly soft water when influent hardness varies. Makes continual soap tests to determine proper end-point of run, then initiates regeneration. Bulletin 2386

Zeolites and ion exchange resins tailor-made to give you long years of trouble-free performance . . . with high flow rates and capacity, low salt consumption. New resins boost capacity of old softeners. Bulletin 4181



Control cubicles integrate and centralize control of water-conditioning systems. Provide semi-automatic or full automatic systems that backwash, regenerate, rinse and return units to service. Bulletin 4178

How Permutit solves your water problem

Here's how Permutit works with you and your consultants to solve your problem:

Complete analysis and study of the problem by Permutit's experts in water conditioning provides data on several methods of treatment. Best process is selected on basis of initial vs. operating costs, balanced against quality of effluent desired.

Complete proposal by Permutit engineers covers type, size, and capacity of equipment along with price and performance guarantees.

Manufacturing – After the proposal is accepted, Permutit designs the entire project, schedules assembly and shipping. Critical parts, ion exchange resins, controls and cubicles are all made in Permutit Plants. (No other U. S. firm makes all these components.)

Test runs – Where required, Permutit checks the installation, supervises start-up and initial operation, trains permanent operating personnel.

For further information call the Permutit office nearest you, or write to The Permutit Company, Dept. WWW, 50 West 44th St., New York 36, N. Y.

PERMUTIT®

a division of PFAUDLER PERMUTIT INC.

WATER CONDITIONING • ION EXCHANGE • INDUSTRIAL WASTE TREATMENT

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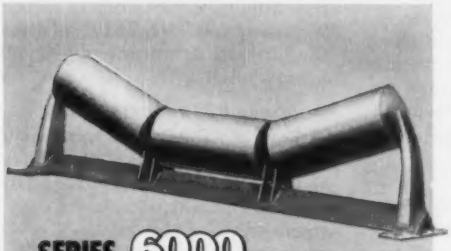
The LINK-BELT idler line for mining . . . now

EVEN BROADER! EVEN BETTER!



SERIES 6000

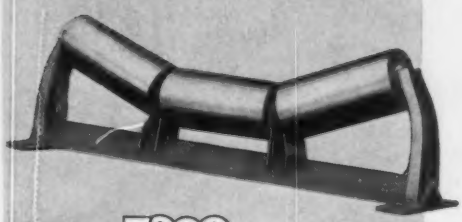
For general conveyor service, maximum loads of 100 lbs. per cu. ft.—moderate lump sizes. Designed for conveyors carrying medium loads or for installations requiring intermittent operation. 14- to 36-in. belt widths. Available with greaseable or factory-sealed precision type ball bearings.

Link-Belt introduces many new types and sizes . . . new features, new numbers

Yes, Link-Belt's newly expanded line permits selection of a belt conveyor idler that matches handling requirements more exactly than ever before. And design improvements have created manufacturing efficiencies that contribute to our ability to offer a quality line without added cost or price premiums.

Ranging in application from light-weight materials of less than 100 lbs. per cu. ft. to such heavy ores as copper and iron, Link-Belt idlers are made for a broad range of belt widths, with rolls of various diameters, materials and coatings. This broad coverage avoids wasteful over- and under-engineering . . . permits "pin-pointing" that results in substantial savings in purchasing and maintenance.

For further facts on this new, expanded line—contact your Link-Belt office or stock-carrying distributor. Look under CONVEYORS in the yellow pages of your phone book. Or write for new Catalog 2716.



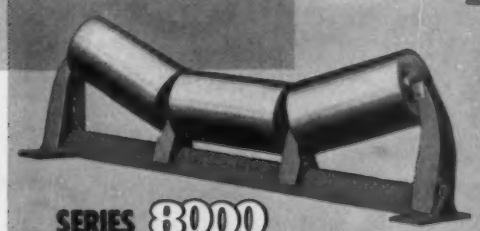
SERIES 7000

For continuous operation . . . high capacities . . . heavy-weight, abrasive materials. 18- to 48-in. belt widths. Equipped with precision roller bearings.

LINK-BELT

BELT CONVEYOR IDLERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,977



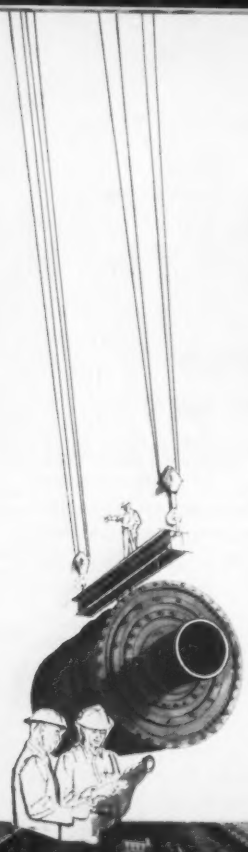
SERIES 8000

For continuous operation . . . higher capacities . . . heavier-weight, abrasive materials. 24- to 60-in. belt widths. Equipped with precision roller bearings.

SERIES 9000

For continuous service . . . highest capacities and coarsest materials. 36- to 84-in. belt widths. Equipped with heavy-duty precision roller bearings.

3 reasons why you should specify NORDBERG GRINDING MILLS



1. Advanced Engineering

Nordberg mill design reflects significant technological improvements that may measurably affect your installation and operating costs. Sealed trunnion bearings; positive bearing lubrication; optimum life of wearing parts are among the features that will benefit you.

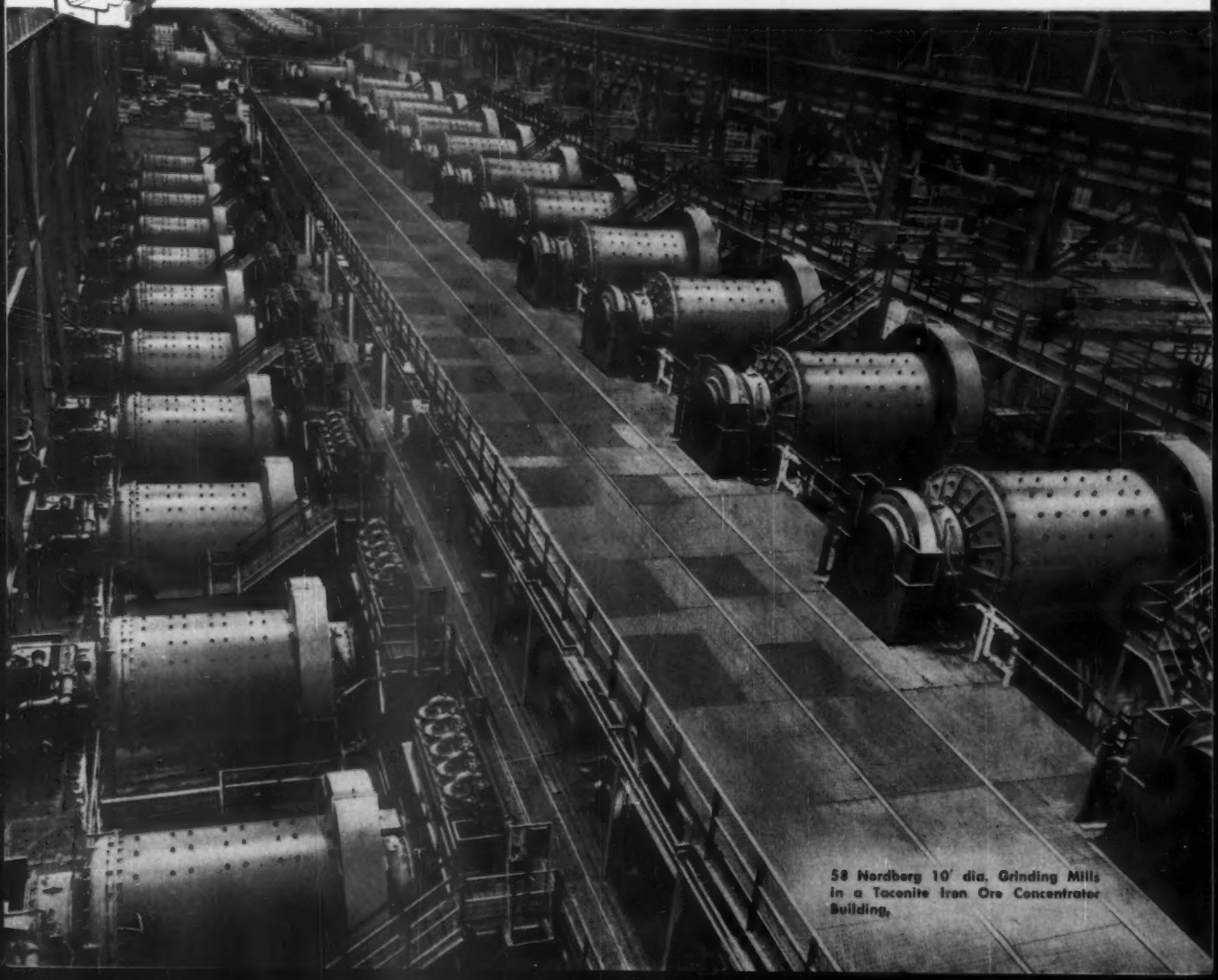
2. Quality Manufacture

Nordberg Mills are (1) precision built to rigid specifications in shops renowned for (2) skilled manufacturing personnel, and (3) modern machine tools and equipment to assure quality workmanship. Good reason why the name *NORDBERG* has always signified the *ultimate* in mining, quarrying and process machinery.

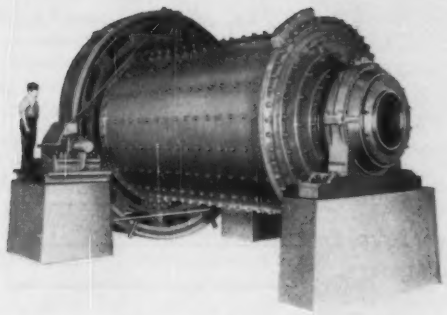
3. Dependable Operation

A team of experienced application engineers with a sound understanding of your milling operations qualifies Nordberg to serve you. More important, it assures you of the right machinery for the job . . . machinery that must be dependable and will continually produce to your specifications.

Nordberg Grinding Mills are built to meet specified conditions for wet or dry grinding—in the manufacture of cement; the fine reduction of metallic and non-metallic minerals; and in numerous other processes where friable material must be comminuted to fine sizes at low cost per ton. They are available with grate, overflow or peripheral discharge . . . and are built in sizes from 6 feet to 13 feet in diameter and up to 50 feet in length.

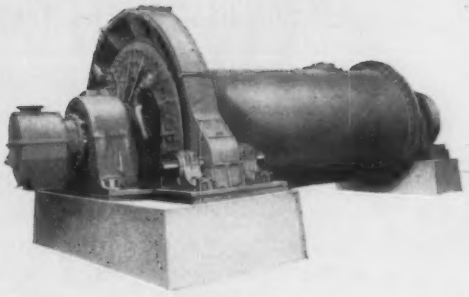


58 Nordberg 10′ dia. Grinding Mills in a Taconite Iron Ore Concentrator Building.



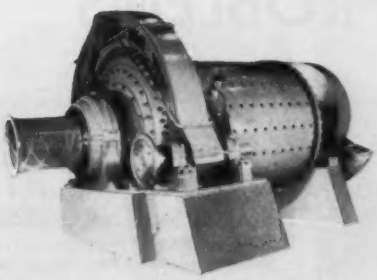
ROD MILLS

For the coarser or primary grinding stages of milling plants.



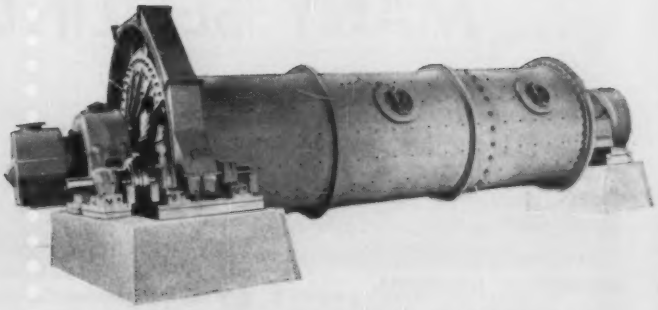
TUBE MILLS

These Nordberg units are used primarily where extremely fine grinding is required.



BALL MILLS

Having principal application in the fine grinding of ores, and minerals, and as preliminary mills operating in tandem or series with tube or compartment mills.



COMPARTMENT MILLS

For multi-stage grinding to ultra-fine specifications, these Nordberg Mills are built in lengths to 50 ft., with two, three, or more compartments.

***BULLETIN 232** covers the complete line of Nordberg Grinding Mills for efficient, low cost processing of ores and industrial minerals. Write for a copy today.*

***BULLETIN 263** describes the advantages of using Nordberg "NI-HARD" for mill liners and other machinery components subject to rapid abrasive wear. Copy on request.*

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

NORDBERG

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NORDBERG MACHINERY

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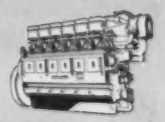
GM258

SYMONS® GYRATORY CRUSHERS

SYMONS CONE CRUSHERS

NORDBERG MINE HOISTS

SYMONS VIBRATING GRIZZLIES and SCREENS



NORDBERG ENGINES

Powerful Chemicals Unlock Earth's Treasures

Wrenching metal from nature's stubborn grasp has always been a tough, tedious job—a job for powerful men and powerful equipment. And it's becoming more and more a job for powerful chemicals such as those discussed below. Chemicals are frequently on the mining newsfront these days because the new ones are doing the recovery job better, faster and at lower cost. Up-to-date information on several Dow mining chemicals is presented below in capsule form for metallurgists who must keep well informed.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

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SPEEDY FLOCCULANTS SOLVE MANY SETTLING PROBLEMS

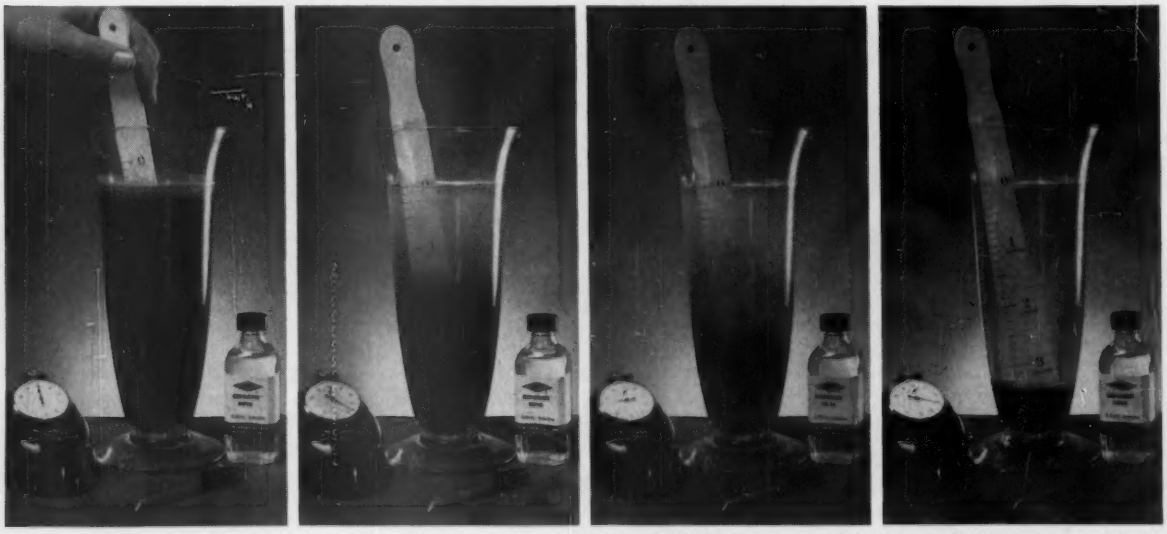
Separan® NP10 and Separan NP20 are pushing ahead on the trail blazed by Separan 2610. They offer money-saving opportunities for metallurgists faced with difficult liquid-solid separation problems.

As a man once said, there are two kinds of apple pie: good apple pie and better apple pie. Such is the case with these two new Separan products.

Separan NP10 is a high power, efficient flocculant while Separan NP20 is the most powerful flocculating material available. Both can now be obtained in commercial quantities for use anywhere in the mining world—from Alaska to Madagascar.

Dow mining technical service men, with their average of sixteen years experience in the mining field, are already working with processors in using the improved Separan products in their operations. Present users of Separan 2610 are advised that laboratory evaluation of Separan NP10 is not necessary. It is an improved form of Separan 2610. In the case of NP20, however, Dow recommends product evaluation because of its increased effectiveness in many operations.

What Separan flocculants will do. To many metallurgists in companies around the globe, Separan is well-known as an old friend. These unique polyacrylamide-type flocculants work with startling speed. This characteristic



Coal solids completely settled in 3 minutes, 20 seconds by addition of Separan NP10, followed by gentle agitation. (Solids content: 5% by weight.)

helps step up throughput without extra equipment! Separan flocculants have aided many companies in decreasing material losses, increasing product recovery, decreasing required thickener and filter area and reducing waste disposal problems. They are effective over a wide pH range.

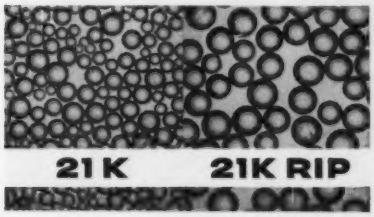
More family members. Separan NP10 and NP20 form the nucleus of a broad line of Separan products now under development in Dow laboratories. This flocculant "family" is providing specialized recovery and separating agents for a number of highly diversified mining applications.

ION EXCHANGE:

"worth its weight in uranium"

New processing ideas are always welcome, but one that works as well as ion exchange in the uranium industry is "worth its weight in uranium".

One of the prime reasons for the achievement of wide experience by



Two new Dowex resins developed for the mining industry.

Dow technical men has been the success of ion exchange principles in the uranium industry. They are applying these principles to many phases of modern industry. Not only are these men experienced but the products they have developed are the finest available.

Dowex resins. The trademark under which Dow markets its ion exchange resins is Dowex®. Several different types of Dowex resins are available for use with specific ores. Dowex 21K and Dowex 21K RIP are two of the most popular. If your recovery is not as great as you think it should be, ion exchange resins might hold the key to more efficient processing. Your inquiries are invited by a skilled ion exchange technical team.

®TRADEMARK OF THE DOW CHEMICAL COMPANY

★ ★ ★ ★

For more information on any of the chemicals discussed in this advertisement write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Department 7661-1.

SOLVENT EXTRACTANTS:

new process expanding rapidly

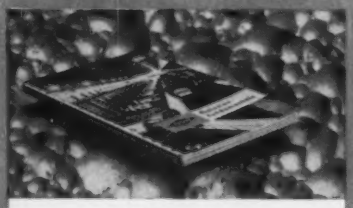
Among hydrometallurgical recovery methods on the Colorado Plateau, solvent extraction is one of the most popular. The main reasons this method is finding favor with uranium processors are its ability to treat a wide variety of ores, its excellent recovery record, and the fact that reagent costs are low.

Tailored for uranium. Dow's two extractants, Dowsol* 12 and Dowsol 17, are also meeting with enthusiastic reception on the Plateau. Both were developed specifically for use with uranium and can also be used to recover thorium, vanadium and several quadrivalent metals. Both are supplied as a 25-30% solution of monododecylphosphoric acid (DDPA) dispersed in a kerosene carrier. Before Dowsol is put to work, the processor further dilutes the solvent with kerosene to a concentration of 2.5% alkyl ester.

When the solvents are contacted with a solution containing metal values, the values are transferred from the solution to the solvent. The barren solution and loaded solvent resulting from such contact are separated via specific gravity differences. After separation, the solvent is stripped of metal values by contact with strip solutions and reused.

Efficiency vs. economy. These versatile solvents have a very low solubility in aqueous solutions, slurries and pulps. Dowsol 17 has lower solubility than Dowsol 12 and is less selective for iron in the ferric state. And its phase disengagement time is more rapid. These two solvent extractants are the first of a growing group of Dow products for specific separation problems. Research and development work is now in progress to provide the mining industry with a wide selection of solvents.

on the MINING CHEMICAL NEWSFRONT



Dowfroth® 250—Powerful, durable frother proves easy to regulate. Write today for new edition of "Flotation Fundamentals."

Chelating Agents—New Texas facilities assure abundant and favorably priced supplies of Versene® 100, other Dow chelating agents.

Muriatic Acid—On land or water, Dow ships HCL when and where you want it from eight terminals. First to ship bulk by sea.

Caustic Soda—86-page caustic soda handbook puts a wealth of NaOH information in compact, usable form. Write for this handy reference now.

Dow Chemicals Basic to the Mining Industry

Flocculants • Ion Exchange Resins • Preservatives • Chelating Agents
Ammonia • Solvent Extractants • HCL • Frothers • Chlorine
Calcium Chloride • Alkalies • Flotation Agents

YOU CAN DEPEND ON DOW

Not for B. F. Goodrich Hi-Torque Brakes

On a grade like this, chances are the operator of a tractor-scraper combination could not depend on conventional brakes for most efficient spreading control. With B.F.Goodrich Hi-Torque Brakes, down hill spreads can be accurately placed and controlled for proper depth.

B.F.Goodrich Hi-Torque Brakes also allow the operator to work faster—and with greater safety—even on terrain that was formerly considered unsafe. With B.F.Goodrich Hi-Torque Brakes the operator can *stop twice as fast* as he can with conventional brakes, and with no fear of brake fade.

The secret of this vastly superior performance is *full circle stopping power.* This exclusive design provides more lining contact area and more constant lining pressure than any other drum brake. Hi-Torque Brakes require no lubrication and have an automatic adjusting feature which eliminates maintenance throughout lining life. Lining changes can be made with standard hand tools.

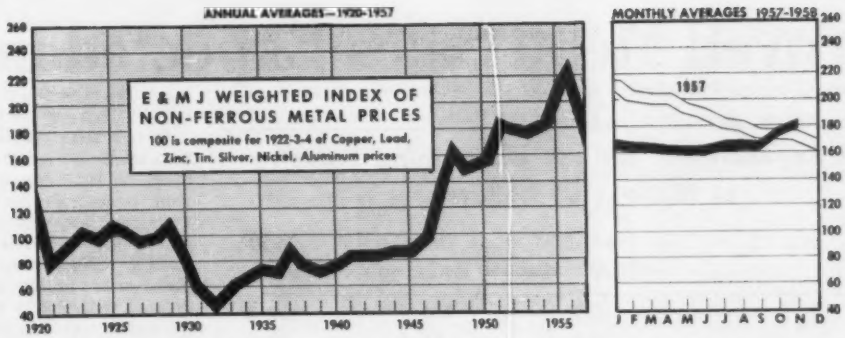
Next time you buy dump trucks, tractor-scrapers or other wheeled off-road vehicles, be sure to *specify* B.F.Goodrich Hi-Torque Brakes. You'll not only reduce cycle time, you'll cut expensive maintenance, too.

Ask your equipment manufacturer for information. Or write: *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Troy, Ohio.*

B.F.Goodrich *Hi-Torque brakes*

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's metal price index continued to move up sharply from 178.00 for October to 184.05 for November. Higher prices for copper, lead, zinc, tin and silver accounted for the rise.

●

AT HOME

National research expenditures will reach $15-billion per year by 1960—or an average of 3% of the cost of goods sold, according to estimates reported by L. G. Bliss, president of Foote Mineral Co.

World use of sulphur in all forms for 1958 is estimated at about 15-million tons, F. M. Nelson, chairman of Texas Gulf Sulphur Co. told stockholders recently. Of this total, 50% is elemental sulphur and 50% is derived from pyrite and metallic sulphides. If the past growth rate continues, Mr. Nelson said that world consumption will more than double in the next 20 years.

In behalf of Nevada mining companies, L. D. Gordon, executive secretary of the Nevada Mining Association, filed a vigorous protest against Senate Bill 4028 pertaining to Government lands because it will prevent the development of mines in many areas in the Western States.

Uranium ore reserves in the U.S., including measured, indicated and inferred ores, totaled 78.5-million tons averaging 0.27% U_3O_8 on June 30, 1958, according to estimates reported by the Atomic Energy Commission and the Wyoming Mining Association. Of this total, about two-thirds is in New Mexico.

Housing starts in the U.S. will total an estimated 1.16-million units in 1958. Current activity in this industry indicates that the 1959 total will be about the same.

The canning industry is one of the largest consumers of metal in the world, according to Reynolds Aluminum Digest. If the aluminum industry could capture only 10% of this market, it would find an outlet for 200,000 tons of metal a year.

A U.S. Geological Survey report, just issued, sets Hawaii's bauxite reserves at 202-million tons. Legislation to regulate bauxite mining in Hawaii will be a problem next year for both the Hawaii legislature and Congress.

●

LABOR

Union grievance procedures are being jammed by an unusually high number of cases resulting from layoffs and rehirings in the metal mining industry.

●

ABROAD

A new uranium deposit has been intersected by drills at Rum Jungle, Northern Territory, Australia. Thus far two major Rum Jungle deposits and a smaller lode have been completely mined out. About 372,000 tons of ore are now held in stockpile to insure capacity operation of the Rum Jungle refinery until mid-1964.

H. C. Koch, president of the Transvaal and Orange Free State Chamber of mines told members recently, "It seems that while a general revaluation of gold is widely regarded as inevitable, many Americans have an irrational fear of it, possibly confusing it with the separate devaluation of the dollar."

THIS MONTH IN MINING

Improved Metal Sales Expected in 1959

Capital Expenditures for the U.S Mining Industry
In Millions of Dollars

	1957 Actual	1958 Estimate	1959 Estimate
Domestic	257.5	235.6	207.8
Foreign	113.3	96.0	52.4
Total	370.8	331.6	260.2

Breakdown of Estimated 1959 Expenditures
In Millions of Dollars

	New Plant and Equipment	Replacement and Modernization
Domestic	171.3	36.5
Foreign	38.6	13.8
Total	209.9	50.3

AN E&MJ SURVEY of capital spending plans and anticipated sales levels for 1959 of all major mining companies indicates that nonferrous metal sales are expected to be 10 to 20% higher in 1959 than in 1958. The range cited for non-metallic mineral products was 6 to 15%. For the nonferrous metals, the expected increase is attributed partly to a greater tonnage and partly to higher metal prices. Strategic mineral producers expressed the least optimism for 1959.

Estimated capital expenditures will be lower in 1959 than those estimated for 1958, and those made in 1957. The accompanying tables show foreign and domestic capital expenditures for the 1957-59 period, and also indicate how much of the estimated expenditures will go for new plant and equipment, and for replacement and modernization.

Several of the companies reporting indicated that the 1959 capital expenditures will be considerably higher than presently estimated if favorable metal prices prevail throughout 1959. Survey returns were received from nearly all large mining companies with foreign and domestic properties. Total sales of all companies reporting were well in excess of $2-billion in 1957. About 40% of all companies large and small surveyed, returned questionnaires. The totals shown in the table do not include expenditures planned by the aluminum industry for mining and metal production, nor for several of the major steel companies with iron ore mining and beneficiation projects. This indicated that capital expenditures for the entire U.S. mining industry could exceed $400-million in 1959.

Several factors account for the decline in capital expenditures. Lower metal prices in 1958 caused the deferment of large projects in the U.S., Canada and Latin America, and a stretch-out in the development schedule of others. Large taconite projects which have been completed or are nearing completion, as well as peak spending in the uranium industry undoubtedly accounted for a higher than normal total in 1957. Reports from uranium companies indicate that substantial expenditures are still being made for expansion and modernization. Several uranium companies reported that they intend to make their first capital expenditures next year.

Despite the fact that total capital expenditures are expected to be lower in 1959, more than half of the companies reporting estimated that their 1959 outlays would exceed 1958 expenditures,

Late Returns

As this page went to press, additional companies returned reports, increasing the total estimated 1959 expenditures from $260.2-million to $279.9-million. Of this amount $223.1-million will be spent in the U.S., and $56.8-million, abroad.

"MORE THAN HALF" of the $8-million goal for the construction of the new United Engineering Center has been subscribed, according to Andrew Fletcher (above), president of St. Joseph Lead Co., who recently assumed the additional duties of president of United Engineering Trustees, Inc.

United Engineering Trustees, incorporated in 1904 for the advancement of the engineering arts and sciences, is administering the construction of the new 20-story Center, on the United Nations Plaza in New York City, which will serve as a new home for the engineering societies and for the famed library, now located on 39th Street.

Mr. Fletcher is a past president of AIME and in 1957 was awarded the Charles F. Rand Gold Medal for "distinguished administration in nonferrous mining and metallurgical enterprises."

Connecticut Company Reopens Beryl Mine

PRODUCTION of beryllium concentrates from a 50-ton flotation mill in the Northeast is due before year-end 1959.

Mag Mining Corp., of New Milford, Conn., has acquired a 30-year lease on the old George Roebling mine, which produced beryl from the early 1900's to 1927. Mag, which holds a total of 103 acres in the area near New Milford, is rehabilitating the mine.

The mill was designed with the cooperation of G. B. Walker, consultant, American Cyanamid, Denver Equipment Co. and USBM, according to Michael N. Arnell, president of the firm.

Exploration Symposium Is Set for AIME Meeting

AN EXPLORATION SYMPOSIUM, under the Geophysics Unit of the AIME, will be conducted in San Francisco during the annual meeting of the parent group Feb. 15 through 19.

Topics to be covered, according to Robert J. Searls, chairman of the unit, include every phase of exploration, and members of management of geology, geophysics and geochemistry will be presented on the panel.

Mining Calendar

National Technical Task Committee on Industrial Wastes annual meeting Cincinnati, Ohio, Dec. 11-12.

Mining Symposium & Minnesota AIME Annual Meeting, Duluth, Minn., Jan. 12 to 14.
Themes: Russian Iron Industry from Mine to Steel Mill; Instrumentation and Controls in Mining and Beneficiation.

Tenth Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, O., Jan. 26 to 29.

Ninth annual Governor's Industrial Safety Conference, Biltmore Hotel, Los Angeles, Calif., Feb. 5 and 6.

Centennial Celebration & Mining Convention, Colorado Mining Association, Denver, Feb. 5 to 7.

AIME annual meeting (San Francisco), St. Francis, Sheraton Palace and Sir Francis Drake Hotels, San Francisco, Calif., Feb. 15 to 19.

Symposium, "The Application of the FluoSolids Reactor to the Mineral Industry," Univ. of Ariz., Tucson, Feb. 23 to Mar. 3.

Twenty-first American Power Conference, Illinois Institute of Technology, Hotel Sherman, Chicago, Ill., Mar. 31 to Apr. 2.

Canadian Institute of Mining and Metallurgy annual meeting. Queen Elizabeth Hotel, Montreal, Quebec. Apr. 13 to 15.

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, Pa., April 27, 1959.

(This month continues on p 126)

As We Went to Press . . .

Mining companies are showing increasing interest in the use of nuclear devices for production blasting. Following encouraging results of the Rainier shot, two more tests are in the offing: one in the potash area of New Mexico (p 162); and a second in the Athabaska sands of Alberta (p 176).

Shattuck Denn's shaft bottomed out Nov. 17 after encountering some water at lower depths which slowed completion from the original target of Nov. 10. A unique three-part system helped the mine and Shaft & Development Machines, Inc. set domestic records. See p 96.

Mt. Isa Mines, Queensland, Australia is planning an expansion, dependent upon improved transportation facilities which the Government has been asked to co-sponsor. Story on p 179.

E&MJ introduces a compilation of technical briefs. See p 146.

Immediate reaction of uranium producers to the Atomic Energy Commission announcement on Nov. 24 that guarantees to buy uranium concentrates from ores produced in the future will be withdrawn was one of alarm. Further study of the announcement modified this reaction considerably. Floyd Odlum, president of Atlas Corp., said AEC's announcement "seems clearly not to apply to presently known ore deposits like those of uranium subsidiaries of Atlas Corp." Gordon Weller, executive vice president of the Uranium Institute of America termed the AEC announcement "a blessing in disguise," because it constitutes a legally binding reaffirmation of the post-1962 price for uranium of $8 a pound of uranium oxide. He also regarded the new program as "a sound basis for the expeditious completion of contracts now pending for increased uranium milling capacity for Wyoming, the Colorado Front Range and southeast Texas, as well as the extension for existing mill contracts which now expire on or before March 31, 1962." Uranium producers in the West conceded that by setting November 24, 1958 as the date of recognition for existing ore reserves, the AEC made its announcements more palatable. The AEC's original plan for extending the domestic uranium market beyond 1962 was never formalized by insertion in the Federal Register. The November AEC announcement, however, was filed with the Federal Register.

Liberia's iron ore reserves continue to grow. Lansdell K. Christie, president of National Iron Ore Co., Ltd. sees reserves of 200-million tons in his company's holdings and Johnstone Avery, presdent of Liberian-American-Swedish Minerals Co. sees an equal amount in the orebody his firm holds on the border between Liberia and Guinea.

Industry members who attended the November National Air Pollution Conference called by the U.S. Public Health Service came away with the conviction that mines, mills and smelters will have to accelerate programs to control air pollution during the next few years if tight Federal controls in this area are to be avoided.

Kennecott Copper Corporation's new Ray Mines Division smelter and leach-precipitation-flotation project was dedicated on November 12. The new smelter is part of Kennecott's current $40-million program for expansion of Ray Mines production facilities, which will permit a 50% increase in production from the Ray pit, and approximately a 40% increase in blister copper production over the 1956 rate. The new project includes a sulphuric acid plant and sponge-iron plant.

WASHINGTON IMPACT

Highlights

NEW FACES OF 1959—The turnover in mining-state Senators in last month's elections was dramatic. It doesn't portend any significant legislative changes for mining (see story this page), but it marks the end of several seemingly solid careers on Capitol Hill.

Perhaps the most startling defeat was that suffered by Sen. George W. "Molly" Malone (R-Nev.), ranking minority member of Sen. James Murray's (D-Mont.) all-important Senate Interior Committee. His seat in the Senate goes to Democrat Howard W. Cannon, Las Vegas city attorney who campaigned against everything Malone stood for except more aid for the mining industries.

The number two and five Republicans on the committee also were upset—Sens. Arthur Watkins of Utah and Frank Barrett of Wyoming. Their successors are Democrats Frank Moss, Salt Lake County attorney, and Wyoming University professor Gale McGee, respectively. One or more of these three Democrats will vie for a position on the committee, and western Republicans are sure to fill the minority vacancies.

On the House side, the only important change in mining-state leadership is the promotion of Democrat Clair Engle of California to the Senate. His chairmanship of the House Interior Committee will go to Wayne Aspinall (D-Colo.), who has been running the group along with Rep. Walter Rogers (D-Tex.) while Engle campaigned.

Rep. Michael Kirwan (D-Ohio) will be back to head up the House Appropriations Committee's mining subgroup, and continue his opposition to domestic subsidies.

LEAD-ZINC CONTROLS—Whether international export or production curbs on lead and zinc are any closer as a result of the second United Nations conference in Geneva last month depends on a number of factors. Officially, the world group moved a step further toward multilateral controls by agreeing in principle that there is a need for them, and setting up a study group to try again to work out a plan.

Domestic producers, represented on the U.S. delegation for the first time, see the study as a way to buy time. But reports of a court test case of current U.S. import quotas continue and if such a maneuver is made by quota opponents, it would spur action on international controls to replace the quotas.

It would also spur the new Congress to take another look at legislative import protection or alternative Government subsidies.

WHAT PRICE BARTER?—Agriculture Department's new barter program for swapping domestic crop surpluses for foreign metals and minerals will unquestionably boost barter for the first time since 1956.

However, checks and balances in the new rules against "abuses" of the program will probably prevent it from reaching 1956 levels again, even though the new crop disposal law (P.L. #480) passed by Congress last session authorizes up to as much as $500-million-worth of barter in the current fiscal year.

A complex country list of nations to which certain domestic crops may now be shipped in exchange for the 26 foreign commodities is one such curb on the barter brokers. It sets out which countries may receive what crops, under what conditions, and amounts to be bartered. Another restriction, held over from Agriculture Department's tight restrictions slapped on barter in the spring of 1957, requires brokers to post letters of credit—or assume financial responsibility—for delivery of the bartered metals and minerals.

There will also be certain time limitations placed on barter deals whenever the CCC deems them advisable.

Nevertheless, barter will be easier under the new regulations. The big hurdle was the "certificates of additionality," now replaced by the complex country list procedure. CCC, although still encouraging evidence of additionality from U.S. brokers, is now taking the burden of proof itself.

Another ease-up on the procedure is the removal of an unwritten requirement—which pre-dates even the 1957 crackdown—that bartered metals processed in the U.S. must be at least 50% foreign in their total dollars value.

Little Change Expected In U.S. Mineral Policy

WASHINGTON PUNDITS are having more fun than usual this season with their bi-annual game of guessing the character and climate of the coming Congress. With more new faces and personalities on Capitol Hill, faster-shifting domestic and foreign problems to speculate about —a rash of new theories on what the 86th will and will not do has resulted already.

For their part, domestic metal-mineral producers and processors have better reason than most to join in the sport of speculation. It was in the mining states that last month's off-year elections scored some of the biggest upsets of familiar names in Congress (see Highlights at left.)

But—aside from obvious questions surrounding any new Senator or Representative which only time and individual performance record can answer—the new Congress promises no sweeping changes for or against the mining industries.

There are several reasons why no major mining policy swings are in the wind on Capitol Hill.

First is the fact that the last Congress more or less settled by compromise the fundamental legislative issues that concern these industries most directly and immediately (*E&MJ*—November 1958, p 20). Basic foreign trade policy was reestablished for four more years, with new avenues to domestic tariff and quota protection opened up but a drive for legislative protection defeated. The failure of attempts to revive defense-based stockpiling proved this issue dead beyond recall, but a scattering of specific Government purchase programs were given stays of execution. Broad subsidy schemes fell into even deeper disfavor, while again certain incentive payments won approval. Tax let-ups were rejected per se at their first appearance before the agencies.

Against this record, however hedged and spotty, the new Congress would have to veer sharply to one side of the road or the other to make significant changes in it. there are solid indications it won't.

Party and committee leadership will remain in essentially the same hands, and neither Congressional nor Administration policymakers have shown any change of mind on the basic issues of trade and protection.

New legislators could make a difference. But there is no hint that any of the freshmen from mining states—regardless of party affiliation—have either the votes or the desire to risk pushing for new legislation that could tip this year's compromises further toward or against the mining industries' favor. For the same reason, non-mining state representatives are likely to ride with status quo.

Over-all so-called liberal Democrats and modern Republicans won weightier representation in the new Congress. Many of them come from mining states, and will be just as concerned with the solution of mining industry problems as their more conservative predecessors. Mining issues have never been a political party province.

The running controversy over what and how much the Government should do to support domestic metal-mineral production will continue next year, with whatever Congressional fights that do develop coming on two main battlegrounds:

One is the area of Government subsidies. Despite the failure of the Seaton-Murray plan last year, it set a precedent for continued Government purchase programs on a commodity-by-commodity basis. This approach is more acceptable to both liberal Republicans and Democrats than the other alternative: Tighter trade restrictions to protect domestic producers.

On the face of it, the new Congress seems to lean toward more spending than more trade curbs. But the issue isn't as clear-cut as it appears. For one thing, President Eisenhower has singled out Government spending as his biggest personal problem with the new Congress, and he will throw all of his remaining political weight against new budget boosts. And the Democratic leadership has promised to meet him "at least halfway."

Although trade policy was re-set with passage of the Reciprocal Trade Agreements Act extension last year, mining-state representatives may feel a new drive for protection from competitive imports. Congress will guard its trade "watch-dog" role jealously, and the lead-zinc quotas were put into effect largely because of Congressional pressure and influence.

The trade protection issue will loom larger than ever if the lead-zinc quotas are challenged and possibly shelved through a court test. The U.S. Customs Court has given quota opponents a precedent on which to fight for their removal: ruling that the President must act on Tariff Commission recommendations within the legally prescribed time limit and either accept them or reject them altogether (*E&MJ*—November 1958, p 20).

Processors who depend on foreign lead-zinc sources and international mining companies with overseas investments are toying with a court test of the quotas. Several already have drafted legal petitions to file in Federal court. Should this maneuver tie up the lead-zinc quotas pending appeal to the Supreme Court, the pressure on Congress to pass new import restrictions—at least on specific commodities—would gain strength. Even if no new legislation is passed, Congress could bring greater political pressure on Administration agencies to grant protection to suffering sections of industry.

Labor This Month

THE 1959 LABOR LEGISLATION SCORECARD: With the new 86th Congress ready for business next month, there are already some clues to its thinking on new labor laws. AFL-CIO president George Meany is leading the union demand for extensive action by Congress on these grounds: that labor supported a hefty majority of the new House and Senate members. Labor wants to cash in on that support. It's asking a wide range of social, economic and labor legislation. But the special aims are these: extensive revision of the Taft-Hartley Act, a moderate labor reform bill.

THE PROSPECTS—WIN SOME, LOSE SOME: Despite the "liberal" Congressional line-up, union officials won't get all they want on Capitol Hill. For instance, a change in Taft-Hartley that would ban state right-to-work laws is out the window. This is too hot a subject for Congress to touch. While the November returns changed a trend to such state laws, it's too soon to turn-about and ban the 19 laws in one fell swoop. Even union leaders don't anticipate success here, though they'll make it a big talking point. They can use Taft-Hartley as a trading point for their version of a labor reform bill—one that is restricted to democratic rules for unions, and curbs on union funds. This is their top target as the best way of getting rid of the racketeering issue. A reform bill, union leaders argue, would eliminate the need for further investigations of racket labor unions.

OTHER ISSUES MEAN COMPROMISE: Union legislative goals cover such topics, too, as Social Security, depressed areas, minimum wage, The Mine-Mill and Smelter Workers will be lobbying, especially, for Social Security advances. Federal aid to chronically labor surplus areas. And, on the minimum wage, labor wants a $1.25 an hour extension of the law to cover retail industry. Part of this package might get through Congress. For instance, the wage-hour law might be extended; but a higher minimum wage wouldn't pass at the same time.

LABOR LEGISLATION RESISTANCE POINTS: What diminishes labor's prospects for a high score in Congress? Number one; the Democratic leadership is still basically conservative; neither the House's Rayburn nor the Senate's Johnson list Taft-Hartley as part of the "must" legislation for 1959. Reform is on the agenda, but that's all. Too, as southern Democratic leaders, they will hope to keep the northern liberal Congressmen in check.

Another check-point is the White House. President Eisenhower flatly opposes a Federal ban on right-to-work laws. He would veto such a bill. He's also demanding a fairly strong labor reform bill; one tougher than the unions want. This means the unions' leaders must still tread somewhat cautiously in the new Congress.

LABOR-MANAGEMENT WARFARE? Some top officials on both sides foresee trouble ahead; a "hardening" of the traditional battle positions of unions and employers. It began earlier this year, with the recession. And it grew in the November "Right-to-Work" election campaigns. According to some leaders, this is threatening to snap already stretched lines of communication. "Management is tougher," says one labor official, and "unions are tougher." It means they are growing farther apart, to where they won't recognize mutual interests.

This doesn't involve differences in collective bargaining. The economic rivalries are accepted by both sides. But, to some, it portends much greater bargaining difficulty in the future. Where it becomes harder for the opponents to exchange views, the bargaining give-and-take is lost. There's already one proposal to check the trend; a continuing labor-management conference patented after the United Nations. A conference that would keep both sides talking and—though they might not reach agreement—help to clear the air.

If something like this doesn't come, leaders anticipate some severe trouble ahead. Even at this point, early consequences are expected to show up in 1959 bargaining. Steel negotiations are the center point where the outburst may come. The fuse has been lit.

MARKETS

Zinc Prices Up; Copper Loses Some of Gain; Barter Reopened

NONFERROUS METAL PRICES as measured by the *E&MJ* index rose to 184.05% of the 1922-'24 average in November from 178% in October. The increase in copper prices contributed most to the rise, but zinc and lead were also significant. Tin and silver were up slightly.

Copper prices rose sharply early in the month. London reached a high of £260 prompt asked on Nov. 6; this was about 32.58c at the day's exchange rate. Katanga was at 31.3c on the 7th. Most custom smelters were at 30c for the first three weeks of the month.

London fell by Nov. 14 to £238 prompt asked, recovered for a few days and dropped further. On Nov. 26 it was down to £223 but recovered to £229, about 28.7c. Custom smelters in the U.S. dropped to 29c, equal to the producer price, late in the month.

The swift fall in Europe beginning Nov. 7 reflected more a correction of excessively high prices relative to the U.S. than a significant weakening of market conditions. Some analysts have pointed out that the U.S. producers want 30c or more for their copper and suggest they may have lost their chance. Others say the opportunity is still present. With the import duty of 1.7c the U.S., since it must be, except for short interruptions, a consumer of imported copper, can be expected to have copper prices at least 1.7c higher than those in most other areas. A variable amount for freight and insurance should be added to this. Current prices in Europe are not too low to "permit" a U.S. producer price of about 30½c and many would say even 31¼c. Wire bars and other standard shapes again have a premium of about ½c to ¾c a pound over the LME. Large consumers on long term contracts with producers do not pay such premiums.

The drop in London was largely owing to the easing in the short situation on the LME, the end of the African strikes, sales of U.S. custom smelter copper in Europe, failure of U.S. producers to raise from 29c, announcement by the U.K. of the intention to sell additional stockpiled copper and heavy sales of scrap by dealers to smelters. At least one large U.K. fabricator resold heavy tonnages. But few fabricators had a surplus of metal.

Copper statistics were even more conducive to a firming market than had been anticipated. Copper Institute figures released Nov. 14 showed world stocks down 106,005 tons in October. In September they had dropped 60,948 tons. In November they will drop again. In spite of increasing output a further drop in December is predicted. Heavy buying by fabricators may occur to adjust inventories for tax purposes.

The highly favorable data are not confined to the copper producing industries. Shipments by U.S. fabricators jumped over 30,000 tons in October and their stocks of copper in all forms dropped more than 17,000 tons even though receipts had increased.

The Rhodesian strikes were settled Nov. 4. The Inco strike in Canada is not settled and prospects for settlement soon are not good.

U.S. Department of Agriculture's barter program, after a long recess, was reopened (details on the mineral products that are eligible, the agriculture products available and the countries to which they may be sent, may be found in E&MJ Metal and Mineral Markets, Nov. 20 and 27, 1958).

Firms in the U.S. which have done barter business in the past expressed considerable disappointment. Some said almost no business could be done because of the many restrictions. Eligible are 26 minerals including lead, zinc, and mercury. Copper is excluded. Each of the farm products and each foreign country are combined into one of three categories: A) those in which only bilateral barter transactions are permitted, B) those in which multilateral are permitted and C) open-end transactions. Farm products and countries have been combined in such a manner, according to many observers, as to restrict barter. If a country has a good financial position so that it might buy for cash then it is in most cases in A, a category in which very little barter business can be done. Many times, the country to which a certain farm product may be sent is one which produces a surplus of that product. The farm products are wheat, feed grains, cotton, tobacco, rice in limited amounts, butter, non-fat dry milk, and soy beans were added two weeks after the initial list.

Provisions for processing raw minerals and ores are highly restrictive. To convert ores into metal or ferroalloys in the U.S. requires the export of agriculture surplus about equal in value to the ore plus the value added in converting. The U.S. metal refiner or ferroalloy producer will want to be paid in dollars; therefore the contractor will need to get dollars for an amount of the farm product equal in value to the processing (in addition to dollars he will need for other expenses). But since the mineral is from a country in which barter can be done it is not likely the contractor can get dollars or convertible currency for the rest of the transaction. He cannot sell the required amount of the farm products in third countries except under rare circumstances. In the case of converting the ore in countries other than the U.S. and the country of origin of the ore, the major difference is that the contractor may not need dollars and may even be able to use soft currencies to some extent.

The provisions of the barter program give the Agriculture Department considerable area for judgement. It states that open-end transactions are to be discouraged.

Zinc was raised by a custom smelter in the U.S. to 11½c per lb East St. Louis Friday, Nov. 7. Heavy sales were made on that day at 11c and at least one seller continued to sell at 11c the following Monday. Total sales for the week ending Wednesday the 12th were the highest on record and reflected buying to get in on the 11c price as well as the belief the price might go above 11½c. Total sales in November (reported to *E&MJ* for calculating weighted average prices) were much greater than usual but less than in October and September. The increasing business has cut down on producer stocks and reduced the amount of price discounts on Special High Grade zinc.

American Zinc Institute data show stocks down in October by 28,000 tons but still high relative to earlier periods. Special High shipments were a record.

Lead sales in November dropped from the relatively high levels of October and September. American Bureau of Metal Statistics for October showed shipments up but stocks down only about 1,200 tons.

London prices dropped to about 3¾c under the U.S. price at N.Y. Before the U.S. import quotas were imposed it was felt the U.S. price was in danger whenever this differential was above 2c. The quotas were expected to isolate the U.S. market and bring about an increase in the spread. The differential may persist.

It is still uncertain that a case against the import quotas on lead and zinc will be brought to the courts, but a case has been prepared with that intention. Basis for the action may be that decisions to adopt them were delayed beyond the time permitted by law.

The UN lead and zinc conference in mid-November in Geneva decided a study group should be established—there was some opposition. Exporting countries had some separate meetings. Some governments opposed limiting exports or production. Though most agreed in principle to this procedure, they were unable to make commitments.

Aluminum price increases in and outside the U.S. are possible in January. Aluminium is dropping its 3½c loyalty discount in Europe in January and this may be the limit of a price increase. Though metal is being imported from Europe to the U.S. at well under U.S. prices, the price might be raised. With capacity increasing, operating percentage for the industry may not increase.

Average Prices November *(E&MJ Quotations)*

Copper:

Electrolytic, domestic refinery	28.665
Electrolytic, export refinery	29.476

Lead:

Common, New York	13.000
Common, St. Louis	12.800

Silver and sterling exchange:

Silver, New York, per oz.	90.125
Silver, London, pence per oz.	77.419
Sterling Exchange	280.553

Zinc:

Prime, Western, East St. Louis	11.367
Prime, Western, delivered (g)	11.867

Tin:

New York Straits	99.022
Gold, per oz., U. S. price	$35.000
Quicksilver, per flask	227.045
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$55.864
Cadmium (a)	145.000
Cadmium (b)	145.000
Cadmium (c)	145.000
Aluminum, 99% plus ingot	26.800
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

No major changes in free market gold prices took place during November. Paris showed a revival of dealings and a rise in bar prices. Coins were higher in Near Eastern and South Asiatic countries and eased in all Iron Curtain centers. The USSR shipped a sizable quantity of bars via Paris-transit to London. Further Russian sales are expected before the year's end. Pick's World Currency Report quotes on "free gold" per fine oz as follows.

	COINS		BARS (12.5 kg)	
	Oct.	Nov.	Oct.	Nov.
NEW YORK	31	30	31	30
transit			$35.08½	$35.08½
MANILA	$42.35	$42.25	35.85	36.00
HONG KONG	46.00	46.45	38.25	38.60
BOMBAY	58.75	61.00	55.50	56.50
TANGIER	40.20	39.90	35.20	35.20
BEIRUT	40.65	42.00	35.24	35.23
PARIS	40.00	40.45	36.30	36.00
BUENOS AIRES	38.80	38.70	36.60	35.15

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of November reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant	29.125 lb
F.o.b. refinery	28.725 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Nov. 1958	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1			No Market				24.700	No Market
3	28.625	30.350	13.000	12.800	11.500	11.000	24.700	97.625
4	Holiday	30.525			Holiday			
5	28.625	30.975	13.000	12.800	11.500	11.000	24.700	97.875
6	28.725	30.425	13.000	12.800	11.500	11.000	24.700	98.125
7	28.625	31.150	13.000	12.800	11.552	11.052	24.700	98.750
8			No Market				24.700	No Market
10	28.675	31.250	13.000	12.800	11.687	11.187	24.700	99.875
11	Holiday	31.100			Holiday			
12	28.625	30.550	13.000	12.800	12.000	11.500	24.700	99.250
13	28.675	29.900	13.000	12.800	12.000	11.500	24.700	99.000
14	28.700	29.375	13.000	12.800	12.000	11.500	24.700	98.750
15			No Market				24.700	No Market
17	28.775	29.225	13.000	12.800	12.000	11.500	24.700	99.125
18	28.675	29.425	13.000	12.800	12.000	11.500	24.700	99.375
19	28.650	29.300	13.000	12.800	12.000	11.500	24.700	99.500
20	28.700	29.175	13.000	12.800	12.000	11.500	24.700	99.500
21	28.675	28.825	13.000	12.800	12.000	11.500	24.700	99.250
22			No Market				24.700	No Market
24	28.650	28.375	13.000	12.800	12.000	11.500	24.700	99.125
25	28.675	27.450	13.000	12.800	12.000	11.500	24.700	99.375
26	28.625	27.175	13.000	12.800	12.000	11.500	24.700	99.500
27	Holiday	27.250			Holiday			
28	28.600	27.725	13.000	12.800	12.000	11.500	24.700	99.375
29			No Market				24.700	No Market
AVERAGES FOR MONTH								
Nov.	28.665	27.476	13.000	12.800	11.867	11.367	24.700	99.022
AVERAGES FOR WEEK								
5	28.706	30.405	13.000	12.800	11.500	11.000	24.700	97.656
12	28.663	30.895	13.000	12.800	11.685	11.185	24.700	99.000
19	28.695	29.445	13.000	12.800	12.000	11.500	24.700	99.150
26	28.665	28.200	13.000	12.800	12.000	11.500	24.700	99.350
CALENDAR WEEK AVERAGES								
Nov.								
1	28.760	30.025	13.000	12.800	11.500	11.000	24.700	97.350
8	28.650	30.685	13.000	12.800	11.513	11.013	24.700	98.094
15	28.669	30.435	13.000	12.800	11.922	11.422	24.700	99.219
22	28.695	29.190	13.000	12.800	12.000	11.500	24.700	99.350
29	28.665	27.476	13.000	12.800	11.867	11.367	24.700	99.022

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Nov. 1958	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1	(e)	(e)	(e)	(e)	$35.00
3	90.125	78.000d.	280.6875	250s. 2 d.	35.00
4	Holiday	78.000d.	Holiday	250s. 1½d.	35.00
5	90.125	77.750d.	280.7187	250s. 1½d.	35.00
6	90.125	77.750d.	280.6250	250s. 1½d.	35.00
7	90.125	77.750d.	280.5937	250s. 2d.	35.00
8	(e)	(e)	(e)	(e)	35.00
10	90.125	77.750d.	280.6250	250s. 1½d.	35.00
11	Holiday	77.750d.	Holiday	250s. 1½d.	35.00
12	90.125	77.500d.	280.5625	250s. 2d.	35.00
13	90.125	77.500d.	280.5625	250s. 2¼d.	35.00
14	90.125	77.500d.	280.5937	250s. 2d.	35.00
15	(e)	(e)	(e)	(e)	35.00
17	90.125	77.500d.	280.6250	250s. 2d.	35.00
18	90.125	77.250d.	280.6562	250s. 1¾d.	35.00
19	90.125	77.250d.	280.6562	250s. 1¾d.	35.00
20	90.125	77.250d.	280.5312	250s. 2¼d.	35.00
21	90.125	77.250d.	280.4062	250s. 3d.	35.00
22	(e)	(e)	(e)	(e)	35.00
24	90.125	77.250d.	280.3750	250s. 4d.	35.00
25	90.125	77.125d.	280.3750	250s. 4¼d.	35.00
26	90.125	76.750d.	280.3750	250s. 3¾d.	35.00
27	Holiday	76.750d.	Holiday	250s. 4d.	35.00
28	90.125	76.750d.	280.4375	250s. 3¾d.	35.00
29	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
Nov.	90.125	77.419d.	280.553	—	35.00
AVERAGES FOR WEEK					
Nov.					
5	90.250	—	280.648	—	35.00
12	90.125	—	280.602	—	35.00
19	90.125	—	280.619	—	35.00
26	90.125	—	280.412	—	35.00

Calendar Week Averages: New York Silver: Nov. 1, 90.375; Nov. 8, 90.125; Nov. 15, 90.125; Nov. 22, 90.125; Nov. 29, 90.125.

(e) No Market (Saturday).

MARKETS (*Continued*)

London Metal Exchange Quotations

Nov.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
3	257	258	239	239½	73¾	74	74	74¼	73	73½	71½	72	749	750	749½	750
4	256½	257	239	239½	74¾	75	74¾	75	73	73¼	71½	71¾	749½	750	749	749½
5	258	258½	240	240½	75	75⅛	75	75⅛	71¼	71½	69½	69¾	750½	751	750	750½
6	259½	260	244	244½	75⅛	75⅜	75⅜	75½	72¾	73	71	71¼	758	759	756	757
7	259	260	246½	247	77⅛	77½	77⅜	77½	73¾	74¼	72¼	72¾	758	759	759	760
10	255½	256	247	247½	77½	77⅝	77½	77⅝	74¾	75¼	72¼	72¾	764½	765	764	765
11	254	254½	246¼	246⅝	77	77⅛	77⅛	77½	75½	75¾	72½	73	761	762	761	762
12	249	249½	242	242½	75¾	76	76½	76¾	76	76¼	73¼	73½	759	760	760	760½
13	243	243½	237	237⅛	75	75¼	76	76¼	75½	75¾	72½	72¾	756	756½	758	758½
14	237½	238	234	234⅛	74½	74¾	75½	75¾	75¼	75½	72½	72⅝	754	756	757	757½
17	243½	244	240	240½	76½	76¾	77	77½	76	76½	73¾	74	755½	756	759	760
18	240½	241	237½	237½	76½	76¾	76¾	77	76½	76¾	73¾	74	757½	758	760	760½
19	238½	238¾	235½	235⅝	76¾	77	76¾	77	77	77¼	74¼	74½	760	760½	761½	762
20	239½	240	237¼	237½	77	77¼	77	77¼	77¼	77⅝	74¾	75	761½	762	765	765½
21	234¾	235	233½	233½	76	76½	76	76½	76½	76⅝	74	74¼	759½	760	762	763
24	227½	227¾	227½	227½	74½	75	75	75½	75½	75⅝	73¼	73½	757½	758	761	761½
25	224	224½	224½	224½	73½	73¾	73¾	74	75¼	75½	72¾	73	758	759	761	761½
26	222¾	223	223½	224	73¾	73¾	73¾	74	75¾	75¾	72½	72½	758½	759½	761	761½
27	226	226¼	226¼	226½	74¼	74¾	74½	74¾	76½	76¾	72¾	73	759	760	762	762½
28	228¾	229	228¾	229	74½	75	74¾	75	76	76¼	73	73¼	758	759	761	762
Av'g's	£242.975		£236.588		£75.584		£75.838		£75.275		£72.803		£757.625		£759.188	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

November 30, 1958

Aluminum ingot, 99 plus % lb.		26.8¢
Antimony, spot, lb., less than carload, in cases		32.59¢
In bulk, carload lots, f.o.b. Laredo		29.00¢
Imported, 10 ton min. (p), 99½%		24¢
Bismuth, ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.45
Calcium, lb., ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb., contract del.		$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957		$2.00
Germanium, per gram, 10,000 gram lots	(c)37¢ — (d)40.2¢	
Indium, troy oz.	$1.25 @	$2.25
Lithium, lb., 98%	$9.00 @	$11.00
Nickel, cathodes, lb. (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.		74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16		35¼¢
Palladium, troy oz.	$15.00 @	$17.00
Platinum (wholesale lots), troy oz.	$51½ @	$55
Quicksilver, flask of 76 lb. 25 flasks or more	$224 @	$230
Selenium, 99 plus %, lb.—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		21½¢
Semi Conductor grade, lb.		$350
Tellurium, lb.		$1.65
Thallium, 100 lb. or more lb.		$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62 @	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958.
(c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	(a)$28 @	(a)$35
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$22 @	$23
48% Cr_2O_3 3 to 1 ratio	(a)$42 @	$44
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi, non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$156.12
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra, $.915 @ $.965, Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18 @	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.05 @	$1.10
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$11.50 @	$12.00
U. S. scheelite, f.o.b. mill	$19½ @	(a)$22
Vanadium Ore, per lb. of contained VO_3 f.o.b. mines		31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton.		$68

(a) Nominal.
(e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5¼¢
Cobalt Oxide, 72¼% to 73¼%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb. eff. Oct. 24, '58		$11.65
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.38 @	$1.39
Imported, incl. 37¢ duty	$.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.68 @	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)		14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovanadium, per lb. of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,470 @	$1,810
Crude No. 2	$788 @	$1,155
Spinning fibers	$353 @	$593
Shingle fibers	$190 @	$220
Paper stock	$120 @	$142
Waste	$82 @	$86
Shorts	$27 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$494 @	$787
Shingle fibers	$142 @	$325
Asbestos, Vermont, f.o.b. Hyde Park:		
Spinning fibers	$353 @	$383
Shingle stock	$172 @	$190
Paper stock	$114 @	$145
Waste, stucco or plaster		$82
Refuse or Shorts	$39 @	$72
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00 @	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84 %	(c)$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap, $20 @ $30.		
Ocher, Georgia, ton in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$30.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30 @	$5.50

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON PRESSURE PRIMER SYSTEM

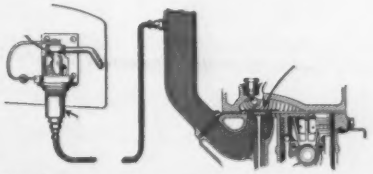
FIRM JONES-TOMKINS CO. Cougar, Washington

Special cartridge fires giant diesel in seconds

At world's highest earth-filled dam construction site near Woodland, Washington, three giant diesel shovels get immediate starts from Chevron Pressure Primer System, reports Jones-Tomkins, general contractors. System helps speed shovel's fill-borrowing operations for this $51,000,000 project. Five-year-old 4500 Manitowoc Speed Crane (above), powered by Caterpillar 350 h.p. V-12 D397 engine, operates 18 hours a day, six days a week, loading 21-yard dump trucks in just 70 seconds. Jones-Tomkins uses Standard fuels and lubricants exclusively on this job.

Chevron Pressure Primer Discharger mounted on instrument panel (left) operates satisfactorily despite heavy vibration, reports shovel foreman Henry Watson (right). "We've had absolutely no trouble with this system. The Chevron Pressure Primer System eliminates dust clogging and allows fluid to reach the cylinders quickly. It's the practical way we've found to get these rigs going."

Why Chevron Pressure Primer System assures fast starts



- Volatile Chevron Priming Fuel atomizes in induction system at all temperatures even at –65°F, no hand-pumping required.
- Pressure or weakest spark from engine fires mixture.
- Simple rugged air-tight discharger prevents Priming Fuel leakage.
- Small, fireproof, pressurized steel cartridges protect Priming Fuel from water and dirt.

For More Information or the name of your nearest distributor, write or call any of the companies listed.

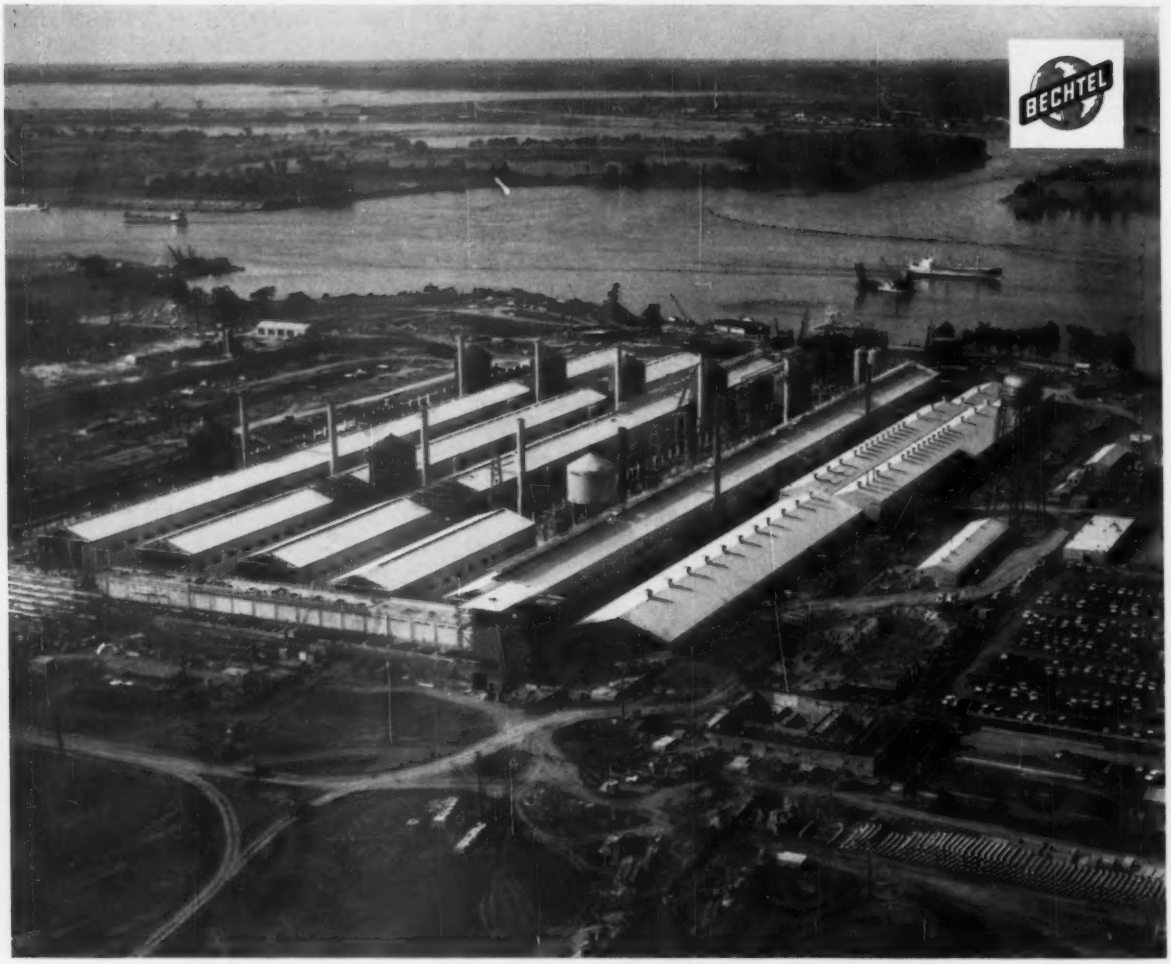
CHEVRON

TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas



Reynolds "Practices What it Preaches" in

ST. LAWRENCE REDUCTION PLANT

Following literally the "build with aluminum" recommendations it makes to architects, structural engineers and contractors, Reynolds Metals Company is using the silvery metal throughout its new St. Lawrence Reduction Plant.

In the six potline buildings included in the plant, which is located at Massena, on the St. Lawrence Seaway in upper New York, there will be 1,150,000 square feet of aluminum sheeting... 382 tons of structural aluminum... 13 million pounds of aluminum bus bars and many miles of aluminum power and lighting cable. Its 12 overhead cranes will be of fabricated aluminum as will the water tank.

First potline in the 200 million pounds per year plant is scheduled to go into operation in May, 1959, with the entire job due for completion late in the year.

The St. Lawrence Reduction Plant is a "turn key" project on which Bechtel has sole responsibility for engineering, procurement, construction.

BECHTEL CORPORATION

Engineers and Builders for Industry

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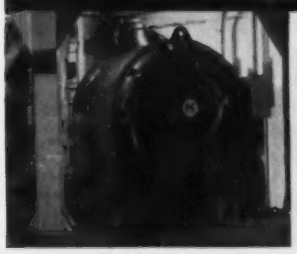
Plan to stay ahead... MODERNIZE!

NEW brochure of ideas for modernizing

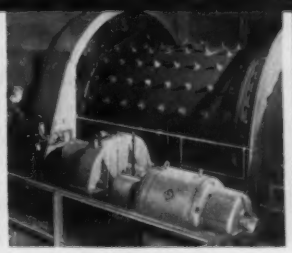
This booklet is based on the premise that modernization can start anywhere in your plant. It can be a single machine or operation . . . a better way of getting variable speed . . . a faster way to braze . . . or a newly available replacement. In fact, this type of updating is far more common than the sweeping change.

Get a copy of "59 ideas for modernization in '59" from your nearby A-C office or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

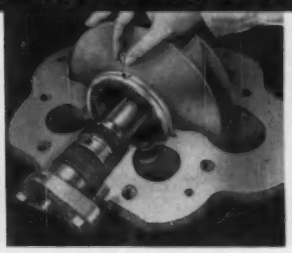
Typical examples of updating ideas!



New motor development may eliminate premiums you've been paying for specially protected motors.



Using one grinding mill in place of two can improve product quality as well as saving space and labor.

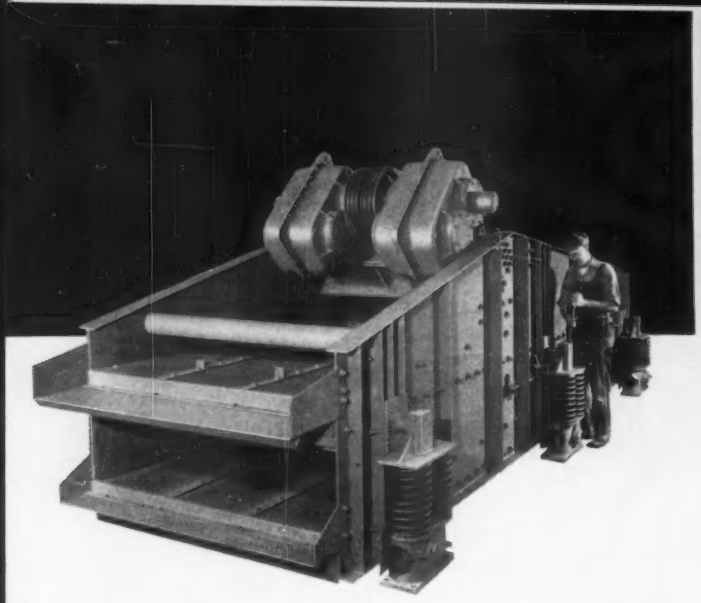


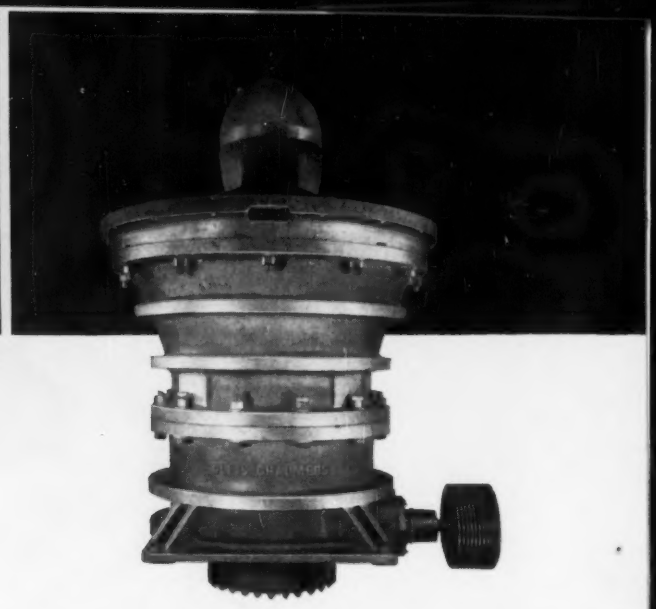
Jamming and clogging in double-suction pumps can be eliminated by pumps with adjustable wearing rings.

Electrical modernization includes placing substations close to machines being served. Roof or basement is often the answer.

A-5851

ALLIS-CHALMERS





Equipment and facilities coordinated to solve application problems

...that's "Coordineering" at Allis-Chalmers

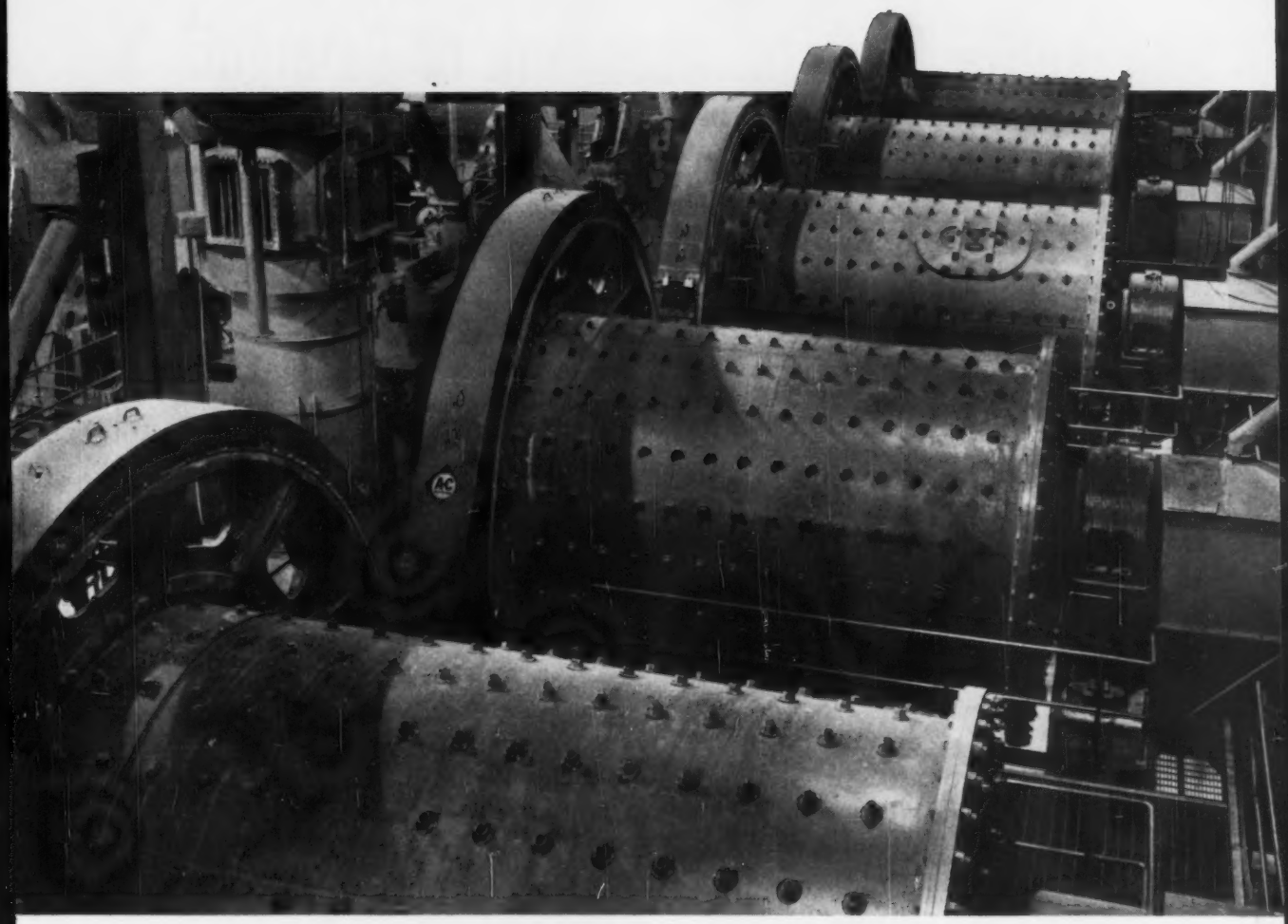
"Coordineering" evolved from Allis-Chalmers vast experience (more than 100 years) in designing and applying major processing equipment for mines and quarries throughout the world. Coordineering begins with the consideration of overall plant design, proceeds to correlated planning by product staffs and follows through to engineering details. It includes testing in industry's best equipped research and pilot plant facilities. It results in maximum plant efficiency and uniform product quality.

It will pay you to investigate our coordineering advantages in the early planning stages of your expansion or modernization program. An Allis-Chalmers technical team will gladly confer with you or your consultants. Call your local A-C representative, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5660

ALLIS-CHALMERS

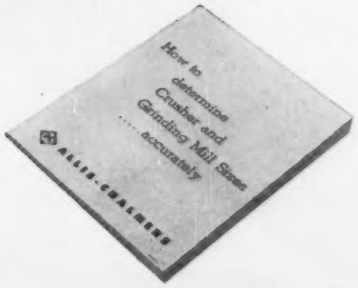


"Coordineered" Equipment for the Mining and Rock Products Industries

Grinding mills — Whether your process calls for individual mills or a grouped-stage grinding series, Allis-Chalmers can make a right-for-the-job recommendation from seven types of grinding mills.

Vibrating screens — Allis-Chalmers screens are built in single or multiple-deck models for use in scalping, wet or dry sizing, washing, rinsing, dewatering and media recovery.

Gyratory crushers — "One-man, one-minute" product control slashes time required to change crusher settings from hours to seconds. Size adjustment, compensation for mantle wear, and emergency unloading are done at the flip of a switch.



"Work Index" Formula

This bulletin explains the "work index" formula — and how you can evaluate any size reduction operation. Compare efficiency of plants, circuits and machines. It offers the only practical approach for improving performance or determining the right machine for a job. Write for Bulletin 07R7995.

Why settle for less, when one of Caterpillar's modern heavy-duty Diesels will fit your needs?

Here's what some owners and users, who wouldn't settle for anything but CAT power, think of their diesels:

"As good an engine as I have ever seen!"

—Tim Fleming, co-owner, Fleming Coal Co., Wise, Va.

"These Cat Engines are economical to operate and don't break down!"

—G. W. Moore, owner of the Moore Coal Co., Wise, Va.

"Our Cat Engines are easy to maintain and have a long life span!"

—A. J. Schmidt, purchasing agent, the William Aloe Coal Co., Imperial, Pa.

"We get good all-around service from our Cat equipment, and from our Caterpillar Dealer!"

—Roy Coulson, division superintendent, Vitro Minerals Corp., Riverton, Wyoming.

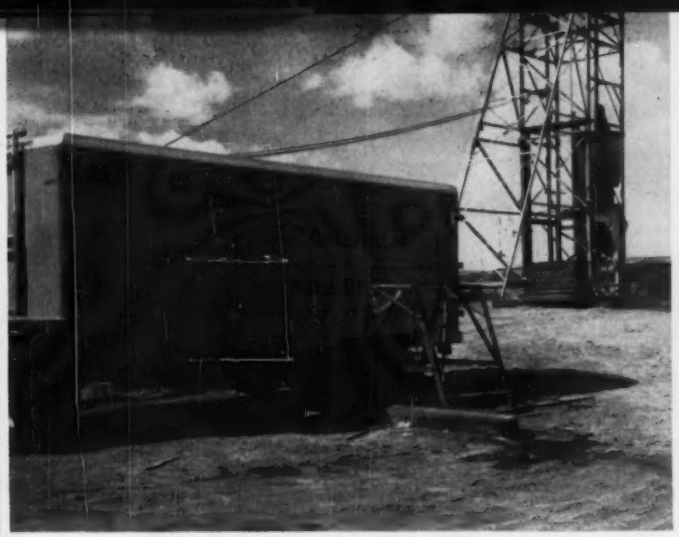
This is typical of owner-user reaction to Cat Diesels. Hundreds of power unit combinations are available to match your specific loads. Cat Diesels are compact, and have a record of highly satisfactory use in all diesel applications throughout the world. And the dealer parts and service that stand behind them insure a minimum of down time.

Each diesel reflects the very latest Caterpillar research, to up production and lower operating costs. Bulk has been eliminated, and extra power and longer life have been added through superior design and metallurgy. The fuel system of Cat Engines requires no adjustment. There are no cylinder ports to clean and Cat four-cycle design provides a smooth, efficient utilization of power. These and other features add up to new performance standards in diesel power.

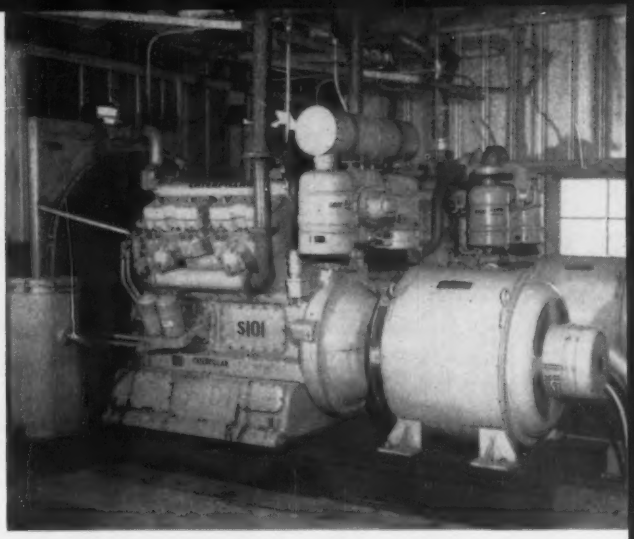
So, for original power or repowering, it will pay you to specify Cat Diesels, available in over 150 other manufacturers' machines. And your nearby Caterpillar Dealer can solve your power problems and give you greater profits.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

A Cat D397 Diesel furnishes power for this Lima shovel, and a D375 powers another shovel loading out slag from stockpile in Steelton, Pa., for C. J. Langenfelder & Son, Inc. Cat Engines are compact, and stand up in the rough shovel work.

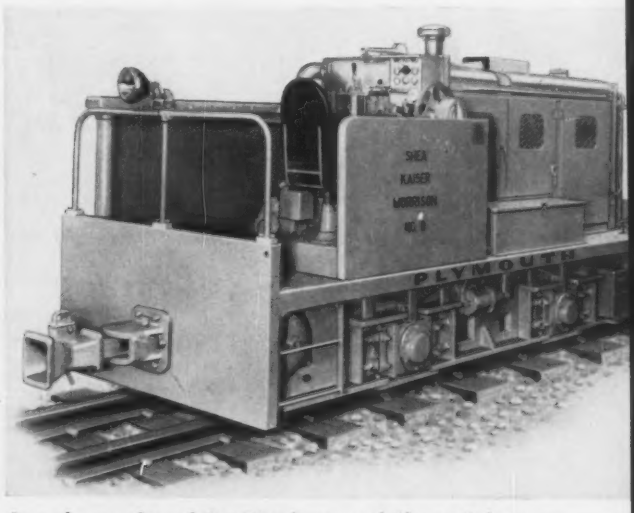


Portable power can move with your job. Here a Cat D397 Mobile Electric Set supplies power for a shaft-sinking operation in uranium fields near Grants, New Mexico. Cat Mobile Electric Sets are dependable, easy to start, and easy to service.



When mining operations begin many companies rely on Cat Diesels. These D375s supply over 450 KW to power hoist, lights, ventilation and battery-charging equipment for underground uranium mine, where "second best" power won't do.

A Cat D318 Diesel Engine powers this Bucyrus-Erie shovel stripping overburden from clay deposits for cement manufacture. Owner of rig is Elmer Gower, Kunkletown, Pennsylvania. Cat engines provide dependable power for excavators.



One of a number of Cat Diesel powered Plymouth locomotives now serving underground on the Trinity River Project near Whiskeytown, California. Owned by Shea Kaiser Morrison, a Cat D326 (Series F) powers this model JL 15-ton unit.

ENGINE POWER BY CATERPILLAR

Engine Division, CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A. **Dept. EM-12**

Send me more information on Cat Engines.

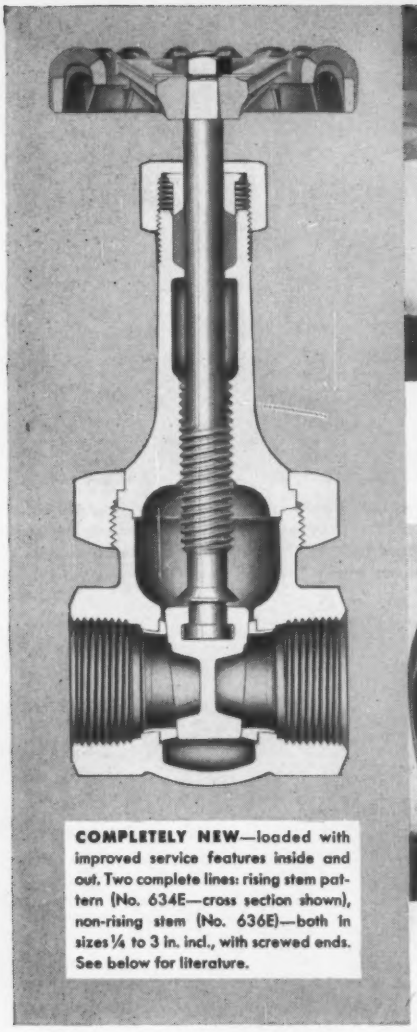
- ☐ I am interested in general information.
- ☐ I would like the names of the 150 manufacturers who can supply Cat power in new equipment.
- ☐ I would like specific information about Cat Diesels for repowering.

Name _____

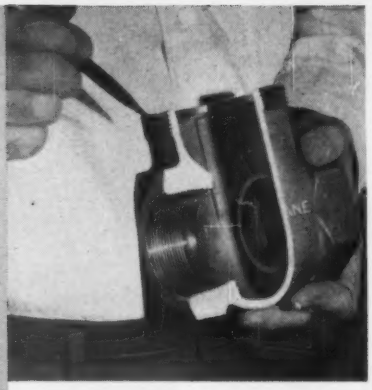
Company _____

Address _____

City _____ *Zone* _____ *State* _____

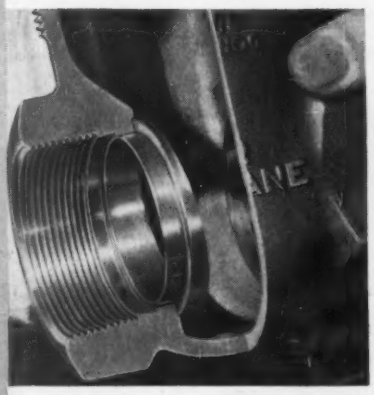


COMPLETELY NEW—loaded with improved service features inside and out. Two complete lines: rising stem pattern (No. 634E—cross section shown), non-rising stem (No. 636E)—both in sizes ¼ to 3 in. incl., with screwed ends. See below for literature.



NEW CYLINDRICAL BODY SHAPE—a proven design on high-pressure steel valves—increases strength without added bulk, distributes pressure load uniformly, resists distortion and leakage at seats.

NEW, STRONGER HEX ENDS, better integrated with body, eliminate sharp contours, give entire valve more rigidity under line strains. Wider hex faces allow firmer wrench grip for easier installation. Marring less likely.



NEW, EXPANDED-TYPE BODY RINGS insure long, tight-seating service life. They're rolled in, can't work loose. Shoulder at bottom of end threads restrains excessive entry of pipe against possible seat damage.

NEW EXELLOY, 12% chromium steel body rings give a hard bearing surface, highly resistant to wear, indentation, scoring and foreign matter damage. Easily replaced bronze disc takes the brunt of normal wear.

New design for tough service...easy maintenance

300-Pound Wedge Disc Bronze Gate Valves

Rising Stem and Non-Rising Stem Patterns

A new body shape that distributes greater strength uniformly against internal stresses and external strains . . . better integrated hex ends, huskier and wider, that add to body rigidity and give a firmer wrench grip . . . new rolled-in, high wear-resisting alloy body rings that don't work loose . . . easily renewed wedge disc—these are typical important features of new Crane bronze gate valves.

On your toughest services, these valves assure ultimate durability . . . new ease of application . . . low-cost repairability. And they're priced no higher than ordinary 300-pound integral seat bronze valves.

Easy to Repair—The Disc Takes the Wear

After long, hard service the hard Exelloy (12% chromium) body rings show no appreciable wear. Normal seating wear is taken by the bronze disc. When needed, a new disc, easily slipped onto stem, provides a practically new, tight-seating valve.

Circular Gives The Facts

For complete technical data on both rising stem and non-rising stem patterns . . . size listing, etc., get Circular AD-2340 from your Crane Representative, or by writing to address below.

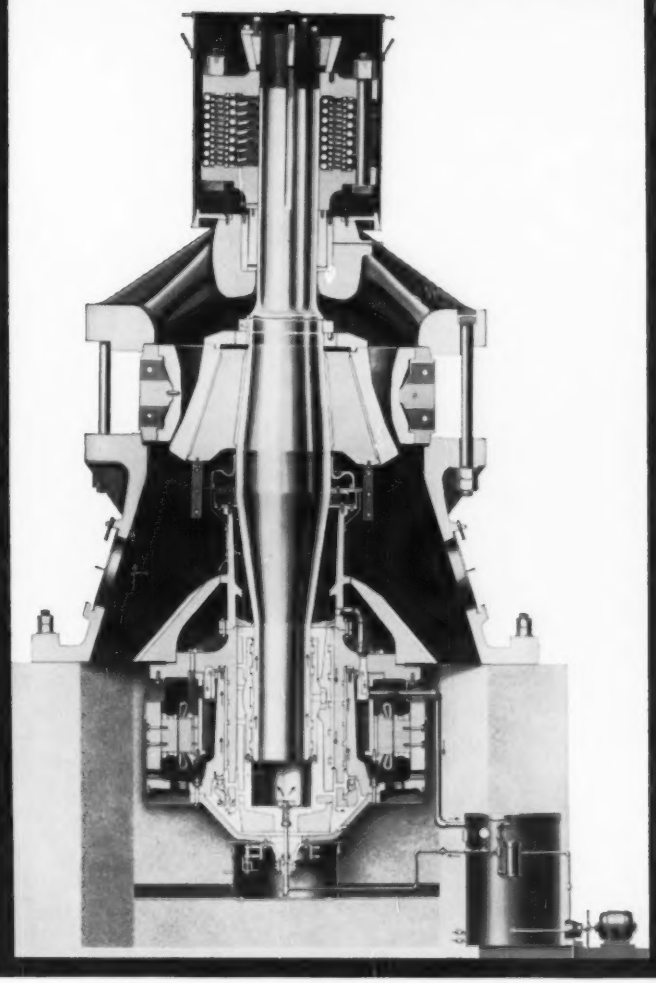
CRANE VALVES & FITTINGS

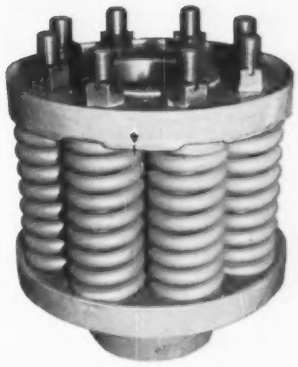
PIPE • PLUMBING • HEATING • AIR CONDITIONING • KITCHENS

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

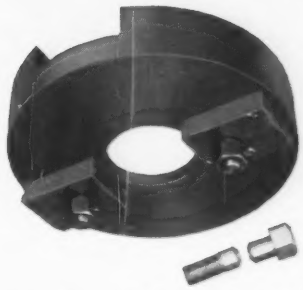
2-WAY TRAMP IRON PROTECTION

Exclusive with the KENNEDY Gearless Reduction Crusher





Ordinary tramp iron and uncrushable oversize is passed by the quick-acting, positive spring cage, without damage.



The KENNEDY patented built-in drive coupling with its overload device, provides positive protection against breakage from unusually large pieces of tramp iron. Operates only when uncrushable material enters crusher.

Uncrushable material inevitably finds its way into every reduction crusher. Only with the KENNEDY Gearless Reduction Crusher is absolute protection assured—for only KENNEDY provides 2-way protection against costly machine damage.

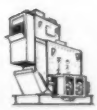
Write today for your copy of Bulletin No. 58-D describing the many other important features of the KENNEDY *Gearless Reduction Crusher.*

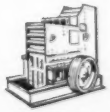
KENNEDY VAN SAUN

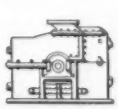
MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary Gyratory


Cuber Senior


Cuber Junior


Hammer Mill

Roll Crusher

Overhead Crusher

Swing Jaw Crusher

AT HOME... ABROAD...

For well over forty years Cyanamid has served the mining industry the world over. And today — Cyanamid supplies a wider range of metallurgical chemicals than any other single source.

Plus providing the chemical tools needed, Cyanamid offers first-hand, in-the-mill assistance in solving beneficiation problems, based on our comprehensive knowledge of ore-dressing technology at home and abroad.

And still our research work continues ... in the development of new products, assuring our customers of even more profitable and efficient operations in coming years.

CYANAMID REAGENTS

CYANAMID

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

225,000 cu yd of Sandstone Gets the "Old Heave-ho" at Sutton Dam

Boring most of the blast holes with Bethlehem Hollow Drill Steel, they recently moved 225,000 cu yd of abrasive sandstone at the site of Sutton Dam, Sutton, W. Va. The Bethlehem Hollow, fitted with both multi-use and carbide-insert bits, put in holes up to 15 ft deep.

Sutton Dam is being built under the direction of the U. S. Army Corps of Engineers, Huntington District. Primarily a flood control dam, it will also regulate the flow in the Elk River, for Charleston's water supply system. Upon completion in 1959, the concrete gravity structure will be 1178 ft long, and 250 ft high.

Bethlehem Hollow is Economical

You can take on any kind of rock and drill it economically with Bethlehem Hollow. It's rolled from a grade of steel that's outstanding for its fatigue resistance. The center hole is true and smooth. And with its wide quenching range, it's easy to heat-treat for the proper balance of toughness and wear-resistance. You'll get both durable threads and shanks.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades in rounds, hexagons, and quarter-octagons, and is regularly furnished in standard lengths of from 18 to 27 ft. Longer lengths can also be supplied. Be sure to specify Bethlehem Hollow for your next rock removal project.

Bethlehem Hollow Drill Steel bores blast holes up to 15 ft deep at site of Sutton Dam on Elk River at Sutton, W. Va. *Contractors:* Arundel-Dixon-Hunkin Joint Venture—The Arundel Corp., The Hunkin-Conkey Construction Co., and L. E. Dixon Co.

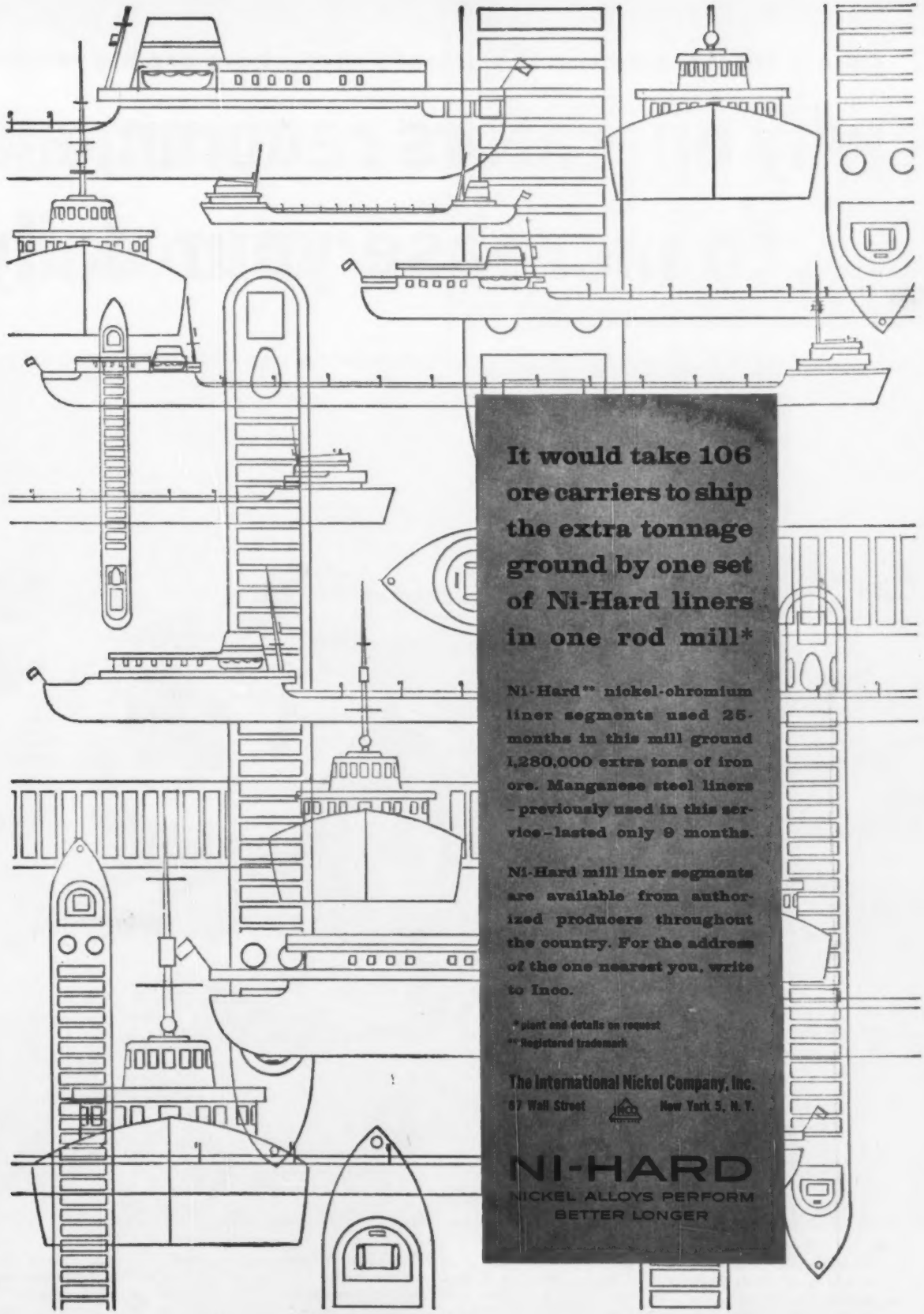
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



It would take 106 ore carriers to ship the extra tonnage ground by one set of Ni-Hard liners in one rod mill*

Ni-Hard** nickel-chromium liner segments used 25-months in this mill ground 1,280,000 extra tons of iron ore. Manganese steel liners – previously used in this service – lasted only 9 months.

Ni-Hard mill liner segments are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

* plant and details on request
** Registered trademark

The International Nickel Company, Inc.
67 Wall Street — New York 5, N. Y.

NI-HARD
NICKEL ALLOYS PERFORM BETTER LONGER

Take it from the man in the driver's seat...here are big reasons

why operators recommend ...to increase your daily

"The International Payscraper does not nose over or up in tight spots," states Operator Cecil Dickson, for C. & Z. Construction Co., Memphis, Tenn. The three "75's" in this fleet each get a heaped 22-yard load in 25-32 seconds—with the TD-24 as pusher. The job: building farm-to-market road near Covington, Tenn.

Operating safety is essential on mountain terrain. Ripon Construction Co., working near Weaverville, California, appreciate International "75" Payscraper safety — handling a subcontract on a road in mountainous Trinity County, with three "75's" and two TD-24's for pusher power. Cuts run to 75 feet deep!

Payscrapers production!

This new TD-20 is pusher for a pair of fast-loading "55" Payscrapers—on a street improvement project in Denver. Horn Construction Co. is the contractor.

Riding on the shock-absorbing, deep-padded seat, the International Payscraper® operator soon learns he can cross rough spots—ascend or descend steep pitches, loaded or empty—without neck-snapping, spine-smacking jolting or bouncing. He practically gets automotive riding comfort!

When he needs positive braking, he has powerful, heavy-duty four-wheel air brakes—synchronized on both tractor and scraper wheels—to decelerate and stop surely, even with heap loads on steep grades. And for "walking" the rig through soggy going, he has auxiliary hand-braking of the individual drive wheels!

Guiding a big earthmover is no longer an athletic event—no longer demands "muscle" or tussle! The Payscraper gives him exclusive Hydro-Steer—hydraulic steering powered for smooth, positive one-hand turns! Even the clutch is air-assisted for operating ease and fast, positive action!

And an operator has no fear of "nose-diving" or jack-knifing—not with International Payscraper design! The oscillating hitch assembly and forward pitched spindle prevents these machine contortions! Low center of gravity means extra stability, too, on uneven terrain.

These are big reasons why operators have the confidence to use full Payscraper power and speed—to give you full capacity and cycle-speeding loading, hauling, and return!

"Our three '55' Payscrapers are best for our land clearing and stripping needs in this sandy area—and we compared thoroughly with competitive machines," states Tom Hutchinson, for Hutchinson Bros., Inc., Pompano Beach, Fla. "We like the way the '55's' boil up a full load fast; then get to the fill and back quick."

Get in the driver's seat—get the operator's feel of International Payscraper performance. See for yourself what a big factor complete operating ease and confidence can be in increasing earthmover capacity! See your International Construction Distributor for a demonstration!

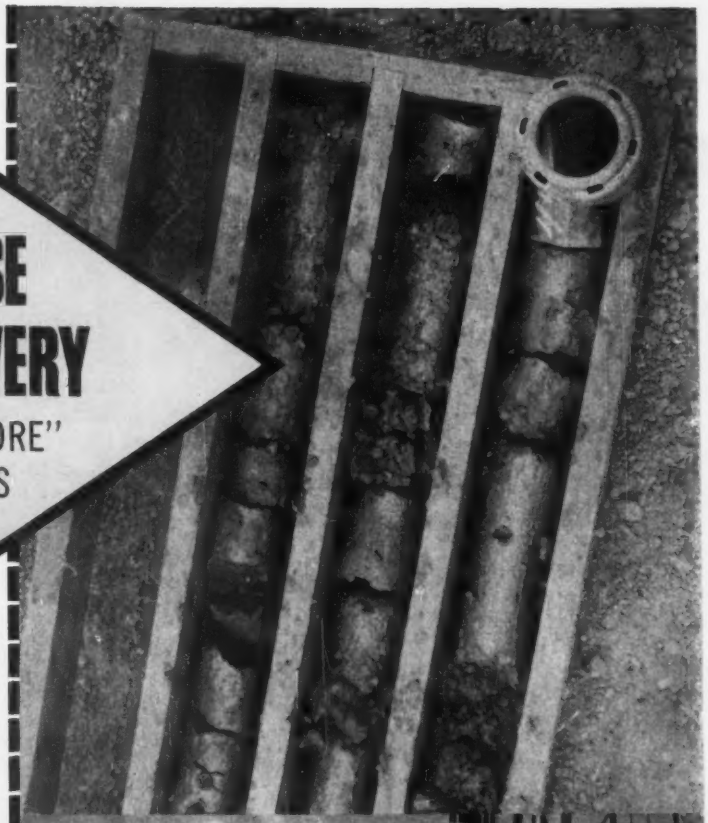
International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors...Self-Propelled Scrapers and Bottom Dump Wagons...Crawlers and Rubber-Tired Loaders... Off-Highway Haulers...Diesel and Carbureted Engines...Motor Trucks...Farm Tractors and Equipment.

INCREASE CORE RECOVERY

IN "HARD TO CORE" FORMATIONS



Christensen adapts equipment to deliver highest percentage core recovery

Until recently the mining industry has had to put up with very poor core recovery in soft, sticky or unconsolidated formations, making accurate analysis of ore reserves extremely difficult. To increase core recovery Christensen, working closely with the operator, adapted equipment to the job. This newly adapted soft formation equipment cores ahead of the circulating fluid, protecting the core from fluid erosion. Today the geologist is receiving complete soft formation cores which enable him to fully analyze the ground below the rig for productive ore bodies. This is the result of a Christensen field consultant working in the field with the operator to adapt equipment to the job. **Whether it is soft formation or hard abrasive fractured rock, Christensen know-how is always available to help you increase core recovery and operate at "less cost per foot," regardless of operating conditions.** Call or write the Christensen field consultant nearest you today.

Every dollar invested in exploration is spent for the sole purpose of evaluating ore reserves. To properly analyze the ground below the rig, the geologist must have "good" cores. Christensen's 4½" x 3", B-3018 barrel delivers best possible cores in soft formations. For more detailed information write Christensen Diamond Products. Specify No. SF-967.

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

Exclusive 4-In-1 "concrete-bucking" pry-over-shoe break-out action—breaks up, digs up, and loads out old pavement—gives big advantages over "single-action" rigs! The new TD-15 4-In-1 exerts the tremendous break-out force of 42,650 lbs! You also get 'dozer, "carry-type scraper," and multi-purpose clam-shell actions in all International Drott 4-In-1's!

NEW International® Drott TD-15 Four-in-One

capacity . . . to outload 100 hp "single-action" rigs plus versatility unlimited . . . of exclusive clam-action

Sized, powered, geared, and **controlled** to decisively outproduce any "single-action" loader in the 100-hp field—the new 2¼ cu yd TD-15 4-In-1 gives you exclusive International Drott clamshell action!

Here's new big-job-sized versatility unlimited! Simply move the selector lever with fingertip ease—to get any one of four big-capacity machine actions needed. On big job after big job, the TD-15 4-In-1 can replace costly big-capacity limited-action machines one after another!

And whether this 4-In-1 replaces four or forty machine actions for you, you get it for one moderate price!

Smooth, years-proved, 115 hp 6-cylinder International diesel engine in the new TD-15 4-In-1 gives you full advantage of increased hydraulic system capacity—of new 6-speed, full-reverse transmission mobility — of new cycle-speeding forward-reverse Shuttle-Bar control!

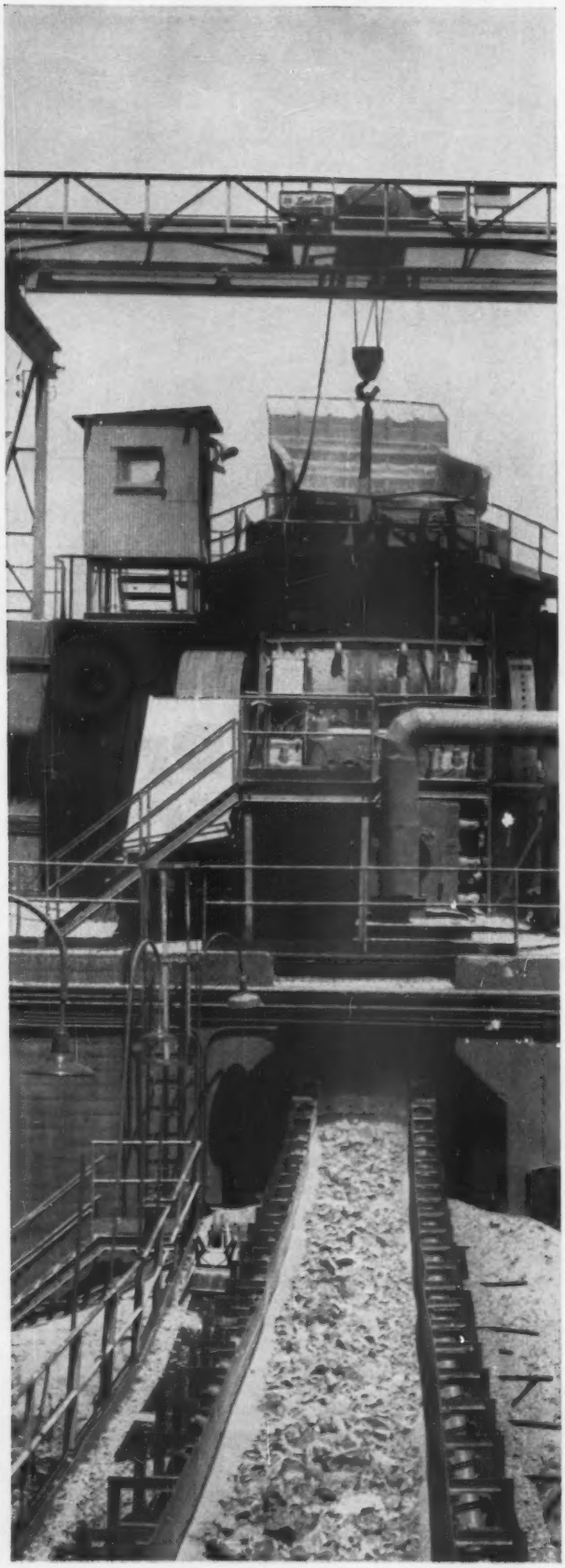
Correct balance and long-track stability eliminate the need for counter-weighting the TD-15 4-In-1. Track length on the ground is a full 98⅜ inches!

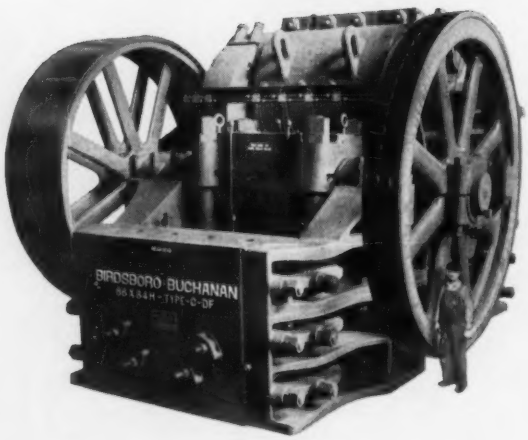
Compare capacity and versatility in your own pit, quarry or strip-mine!

There's only one way to size-up TD-15 4-In-1 performance—to measure its job range and capacity—to compare its money-making capabilities to a yard-full of one-purpose rigs. That's to get on the deep-cushioned seat and prove to yourself what it can do. See your International Drott Distributor for a demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®





Birdsboro-Buchanan Crusher Utilized at Kaiser Steel's Eagle Mountain Mine

• A giant 66″ x 84″ Birdsboro-Buchanan crusher is being used to meet current production quotas for primary crushed iron ore at Kaiser Steel Corporation's Eagle Mountain, California, Mine. The iron ore will feed the West Coast's only blast furnaces.

The crusher is of an advanced deep-frame design with longer swing jaw for faster crushing to small sizes. A Birdsboro representative can tell you about the progress of this crusher installation, as well as hundreds of others, many in operations just like yours. *Main Office, Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

CR 23-58

BIRDSBORO

STEEL FOUNDRY AND MACHINE CO.

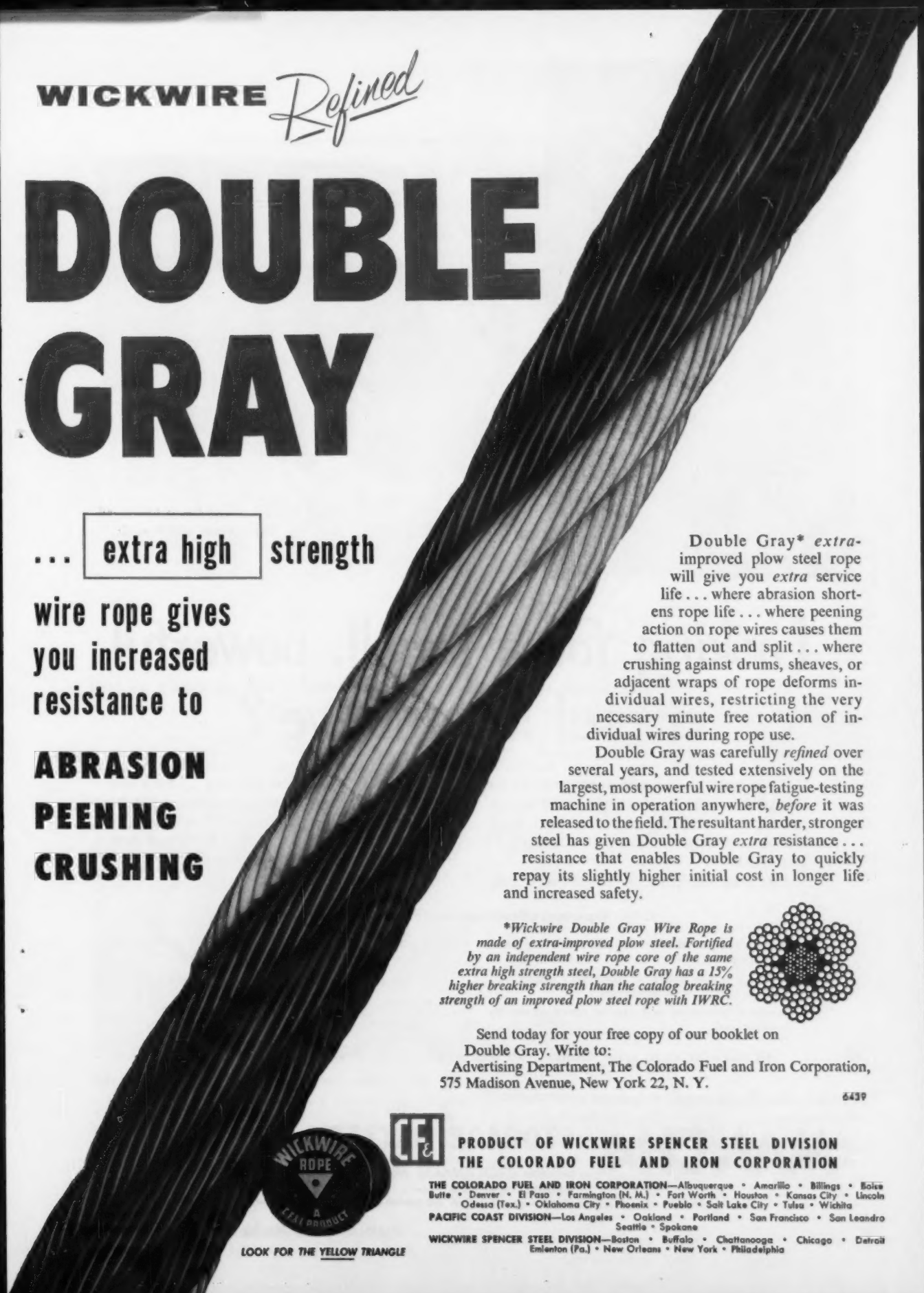
STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design ROLLS: Steel, Alloy Iron, Alloy Steel

WICKWIRE *Refined*

DOUBLE GRAY

... extra high strength wire rope gives you increased resistance to

ABRASION
PEENING
CRUSHING



Double Gray* *extra*-improved plow steel rope will give you *extra* service life . . . where abrasion shortens rope life . . . where peening action on rope wires causes them to flatten out and split . . . where crushing against drums, sheaves, or adjacent wraps of rope deforms individual wires, restricting the very necessary minute free rotation of individual wires during rope use.

Double Gray was carefully *refined* over several years, and tested extensively on the largest, most powerful wire rope fatigue-testing machine in operation anywhere, *before* it was released to the field. The resultant harder, stronger steel has given Double Gray *extra* resistance . . . resistance that enables Double Gray to quickly repay its slightly higher initial cost in longer life and increased safety.

**Wickwire Double Gray Wire Rope is made of extra-improved plow steel. Fortified by an independent wire rope core of the same extra high strength steel, Double Gray has a 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC.*

Send today for your free copy of our booklet on Double Gray. Write to:
Advertising Department, The Colorado Fuel and Iron Corporation,
575 Madison Avenue, New York 22, N. Y.

6439

WICKWIRE ROPE — A CF&I PRODUCT

LOOK FOR THE YELLOW TRIANGLE

CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise Butte • Denver • El Paso • Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln Odessa (Tex.) • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Tulsa • Wichita

PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro Seattle • Spokane

WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit Emlenton (Pa.) • New Orleans • New York • Philadelphia

Now—U.S. Bureau of Mines Approved
for Metal Mines and Tunnels

Looking for a small, powerful diesel locomotive ?

When drifts are too narrow and crooked for a large locomotive . . . when a small storage battery unit lacks the power to keep loads moving profitably . . . you need Mancha's 2-Ton Diesel.

This small but powerful locomotive is only 47″ high, 37″ wide, and 88″ long . . . but it will easily handle trailing loads requiring 1000 lb. drawbar pull on a 24 hour schedule. Low first cost, low maintenance cost, and low operating expense make it profitable for any mine considering diesel haulage.

Other important advantages of this locomotive include:

- Single speed transmission with gears always in mesh, no shifting.
- Hydraulic torque converter to balance engine output to drawbar pull requirements.
- Smooth acceleration, and ease of speed control by throttle lever.
- Rapid change of direction possible through simple transmission brake, jaw clutch operation.
- Two cylinder, four cycle engine of standard design.
- Effective exhaust scrubber.
- Convertible track gauge, 18″ to 24″.

All this adds up to lower hauling costs and greater profit. Write today for catalog M-113.

MANCHA STORAGE BATTERY LOCOMOTIVE

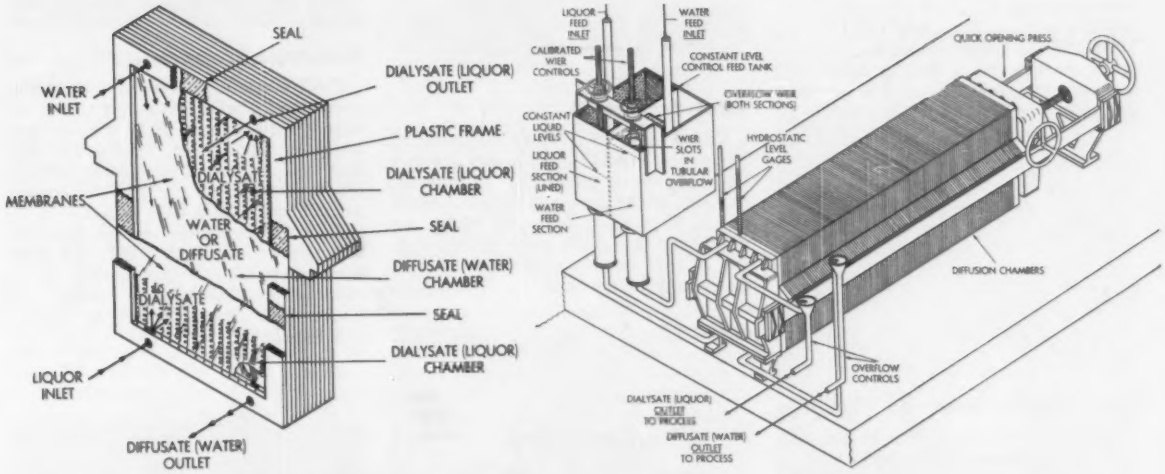
DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.

E&MJ NEW PRODUCT DIGEST

In this issue—Dialysis membranes that recover acids from process solutions, the opening of Bucyrus-Erie of Canada Ltd.'s first plant, an Allis-Chalmers compacting process package for a French potash producer, and other new items of mining equipment. Also a visit through McGraw-Hill's World News Service to the Essen Mining Exhibition with emphasis on improved techniques and equipment.



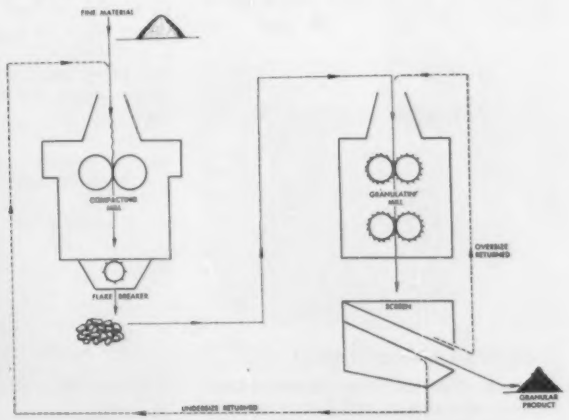
Dialysis Equipment and Acid-Resistant Membranes Recover Process Acid (1)

Specially treated dialysis membrane developed by Graver Water Conditioning Co. can be used to recover and concentrate acids from leach liquors. Among the chemicals that can be recovered in Graver's Hi-Sep Dialyzer are sulphuric, hydrochloric, nitric, chromic, phosphoric and acetic acids. Suitable membranes can also be supplied for recovery of caustic soda.

Graver's Hi-Sep unit is an integrated system complete with head tank and flow regulators. Exclusive feed control maintains a constant head. Unit is designed to recover up to 99% of the acid.

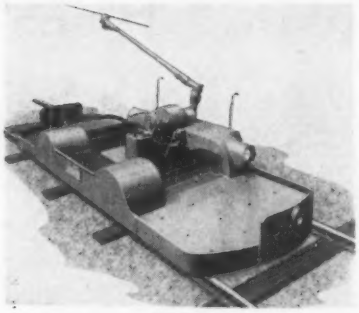
Bucyrus-Erie Co. of Canada Dedicates Plant (2)

On Oct. 31, more than 700 guests attended the Bucyrus-Erie plant dedication at Guelph, Ont. where B-E staged a plant tour and equipment demonstration. Five major models of cranes and excavators—three of which are already being built at the plant—formed the nucleus of the show. Shown here are two Canadian-built 22-B's, a hoe and a dragline, with ¾-yd capacity buckets. Check number for details and location of B-E distributors in Canada.



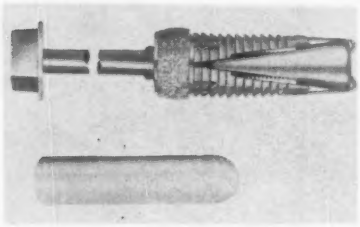
Continuous Compactor Upgrades Potash (3)

An Allis-Chalmers Mfg. Co. continuous compacting system is being installed at a potash mine in eastern France to upgrade and reclaim valuable potassium chloride fines. System contains a roll compactor which produces a continuous sheet of potash (or any other inorganic chemical), then breaks the sheet into flakes. Flakes are fed to a granulator which feeds to a screen. Undersize returns to the process.



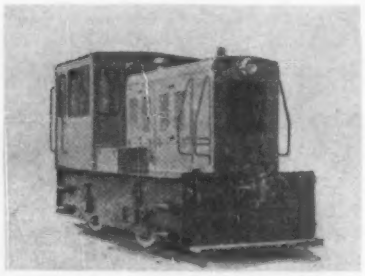
Mechanic's Jitney (10)

Lee-Norse Co. has introduced a mine mechanic's Jitney, designed for servicing emergencies and capable of accommodating five persons. Body height is 19⅜ in., with 3½ in. ground clearance, and the unit operates on a 7½-hp open type motor. Jitney takes either 250 or 500-v dc trolley.



Roof Bolting Process (11)

Patented method, known as the Air-Seal resin process, is available for use in haulageways and airways which must be kept open. Especially suited for soft or failing roofs, the process employs an air-sealed plastic in a container which is pushed into place in the bolt hole ahead of the anchor and bolt. Resin fills anchor and hole down to the sealing washer, then solidifies quickly into a tough, adhesive mass, according to Pattin Manufacturing Co.

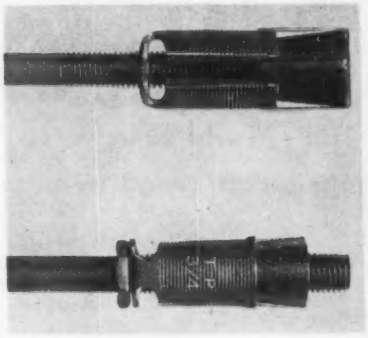


Industrial Locomotives (12)

Rogers Brothers Corp. has announced facilities for design and construction of industrial locomotives of diesel-hydraulic or diesel-electric design in 5- to 40-ton sizes and track gages from 21 to 56½ in.

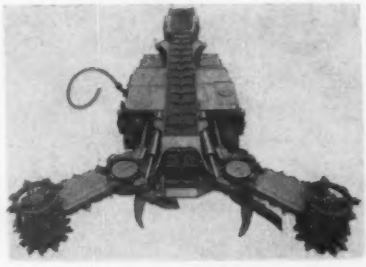
Beefed-Up Blastholer (15)

Ingersoll-Rand's Drillmaster is now available with a beefed-up mounting that, according to the manufacturer, makes the blastholer even more rugged and portable than ever before. Trucm-3 can be set up in only a few minutes since the tower is raised and lowered hydraulically. Trucm-3 has drilled as much as 350 ft of hole in a single shift.



Roof Bolt (13)

Called Top-Tite, Valve Division of Thompson Products, Inc.'s new product has been mine tested for 14 months. Features of the new bolt are—fine tooth leaves, large plug, faster tightening, no misalignment and the plugs cannot drop out or pull out. Bolts are packaged in heavy duty burlap bags.



Low Coal Miner (14)

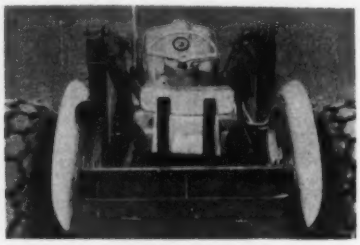
Lee-Norse Co. says that their 16-ton LCM-28 Low Coal Miner is designed for seams 30 to 48 in. high. Miner employs a combination of cutting and gathering coal as its vertically-mounted extendable cutter drums arc together like a clam shell.

Wheeled Trailer (17)

Easy Easton Car & Construction Co.'s Model TS-1622 Rear Dump, variable wheel base trailer is designed for use with the Euclid Model S-12 tractor. Rated capacity of the trailer is 22 tons.

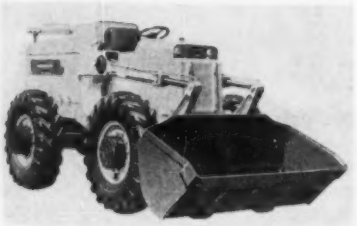
Crawler Loader Front-End (18)

Koehring Div., Koehring Co., says that the crawler-mounted front end loader, the Skooper, can load 400 tph, operating on only 70 hp. Skooper is available with buckets ranging in size from 1⅞ to 2½ cubic yd.



Industrial Tractors (19)

Ford Motor Co., Tractor and Implement Div. just recently introduced an entirely new line of Ford tractors and matching high-capacity loading and digging equipment. An all power steering system is used on the tractor. Steering wheel requires less than a full turn to move the tractor from straight ahead to full right or left. Models 1821 and 1841 have 42.5 drawbar horsepower in 4-cylinder gasoline engines. Series 712 loaders have bucket capacities of ⅝-, ¾-, and 1-cubic yd.



Wheeled Tractor Shovel (20)

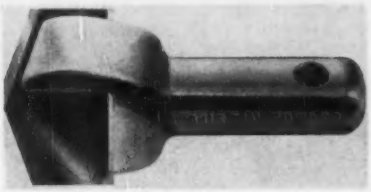
Frank G. Hough Co. has introduced a four-wheel drive tractor shovel with 3½ ton carrying capacity, the Model H-70. Gasoline or diesel engines with 105 to 110 hp ratings are available, according to the company.

Truck Crane (21)

Construction Equipment Div., Baldwin-Lima-Hamilton Corp. has begun production of a four-axle 50-ton capacity truck crane known as the Type 64-T. Carrier is a Lima design and is available in 8x4 and 8x6 drives.

Truck Body (22)

Special rock body dump was developed by Galion Allsteel Body Co. for a southern Indiana coal company. Unit is an oversize 16x9 ft body with double acting telescopic hoists to lift the 20 cubic yd skip and to lower the body from its 70 deg dumping angle. Body has 2-in. oak cushion under the ¼-in. steel batter plate. Shell is 8-gage steel, according to the company.

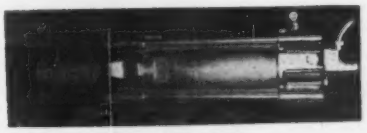


Carbide Roof Bit (33)

Austin Powder Co. has announced Model RDA roof bit that is designed to withstand the shock and abrasion of high speed drilling in all types of rock. RDA's are available in two sizes for drilling 1⅜- and 1½-in. holes. Recommended for rotary type roof drilling in wet or dry work.

Down-the-Hole (37)

Joy Mfg. Co. has introduced two models in the down-the-hole line—DH6 (6¼ to 7 in. hole sizes) and DH10 (9¼ and to 10 in.). Patented built-in valve keeps dirt and water out of the machine. Joy Downholer has direct line pressure which blow air direct to the bit and the cutting edges of the carbide.



Percussion Drill (36)

Joy TM600, a six-inch bore deep-hole percussion drill, takes over where the Joy TM500 leaves off, yet uses the same mountings and same type drill steel as the TM500, according to Joy Mfg. Co.

McGraw-Hill World News Service Visits the Essen Mining Exhibition

THE RANKS of well-ordered and painstakingly organized German exhibitions were badly broken this month when the Fifth German Mining Exhibition opened its gates at Essen to the general public on September 13, 1958. A "relaxed" organization on the part of the exhibition management, however, was balanced out by the excellent arrangements made by the majority of the exhibitors, to show off their wares spread out over the spacious flower-bedded Gruga Park.

The show, fifth of the series, was by far the largest to date with 530 exhibitors representing seven countries. The seven exhibition sections, including mine safety and coal technology were housed in 20 halls and over a vast area of open-air space.

Bearing in mind the fact that most of the equipment and methods on view were suitable only for British or Continental application and cannot apply to conditions in the U.S., it came as little surprise to find that none of the roughly 15 U.S. manufacturers at the exhibition were directly represented but had left arrangements and showing to their European dealers. As well, visitors from the U.S. were vastly in the minority with the largest contingents coming from the U.K., France, Russia and Japan.

One of the more prominent of the few American visitors to the show, Prof. Joseph Keenan, Colorado School of Mines, and president of Thompson Creek Coal & Coke Corp., deplored the lack of American interest but reasoned that though Continental machines and methods were good on the whole, it would be extremely difficult and often costly to modify or adapt them to current U.S. practices.

One of the machines which particularly took his fancy was the Peissenberg-type ram plough exhibited on the Westphalia-Luenen stand. Keenan added that a coal-getter of this kind would be ideal for working pitches over 25 deg particularly when seams were thin, but he advocated the inclusion of an infinitely variable speed drive into the design in place of the standard two-speed transmission.

American industry was represented by Clark Trucks who showed a full range of diesel, gasoline, and battery-powered fork lifts: Joy featured continuous miners, loaders, trackless cars, limberollers, dust collectors. Cleveland Twist Drill Corp. showed their products on two stands in Hall 6 and Hall 9 Ingersoll-Rand occupied a prominent position in Hall 1 and utilized the space to advantage to show off air and gas centrifugal pumps

Mine Safety Appliances Corp. teamed up with their new German subsidiary, the Auergesellschaft AG to show a wide range of protective equipment against respiratory hazards, gas detectors, testing apparatus

Eimco Corp. featured their full range or rocker shovels together with tractor excavators, conveyor loaders, and front-end loaders Longyear was doing good business it seemed with their new wire-line drilling equipment, though plenty of interest was also centered on the other conventional drilling equipment and surveying instruments

Atlas Copco had a full range of pneumatic equipment going full blast on their large, extremely decorative open-air stand.

The German subsidiary of Babcock & Wilcox showed boilers, furnaces, dust separators and water-treatment plants. Other U.S. firms showing equipment through the medium of their European dealers were IBM, Eastman International, Edison Accumulator Co., Templeton Kenley, Cushholm Moore, Rodgers Hydraulic, Columbus McKinnon Chain Corp., and Lug-All Co.

The only representative at the exhibition from behind the Iron Curtain was Nikex, a government-sponsored Hungarian trade group handling heavy industrial products. They showed various types of winches, charging equipment, flameproof primers, and special lighting installations for derricks.

Featured at the Guetehoffnungshuette booth was their torsion pit prop with a novel type yoke and a pre-set hydraulic tension device. Torsion effect of the yoke not only gives a higher clamping load than in normal jacks but also has completely eliminated the normal manual wedge driving problem. Tension device can be moved from prop to prop. The miner has no dials or gages to watch as the device is pre-set and will automatically trip as the load level is reached. **(44)**

Hausherr (of Sprockhoevel) featured a series of automatic high-pressure water infusors using water and air entering the unit at about 70 psi prior to being squirted in a continuous stream into the drill hole at a pressure of about 3,900 psi. **(45)**

Siemens & Halske (of Erlangen) showed their new Inframeter for accurately recording the presence and quantities of firedamp. This instrument exploits a methane gas characteristic of absorbing infrared rays of certain wave lengths. Any fluctuations in the amount

of methane gas contained in the air will cause a variation to the intensity of an infrared ray, the degree of variation being expressed then in differences in electrical resistance. **(46)**

A coal or ore picking installation shown by Krupp (of Essen) was so completely automated that only four men per shift were required to handle 1,000 tons of coal (or ore) per hour instead of the 100 men earlier used for this work. **(47)**

Deutsche Waggon und Maschinenfabrik (of Berlin-Borsigwalde) unveiled a new mobile refrigerated air conditioning plant for use underground. Electric drive motor and compressor are contained in a gas-tight housing designed to eliminate trouble-prone stuffing boxes. The refrigerant used is Frigene 22. **(48)**

The Caterpillar exhibited by Becker-Pruente is an interesting underground haulage device—a series of lightweight wheeled skips united end-to-end by sections of rubber pieces that allow the train to negotiate curves, turnouts and dump over the pocket. At the pocket, one rail curved upward to tilt the skips. **(49)**

Ruhrdynamo (of Duisburg) featured a welding locomotive powerful enough to haul its own maintenance and crew car. The welding generator direct-coupled to the drive motor has a range of regulation extending from 50 amp at the bottom of the scale to a maximum of 300 amp. To facilitate movement through blind or staple shafts and narrow gateways, the locomotive cab can be folded together to reduce the over-all buffer length of the unit from the normal 90 to 70 inches. **(50)**

Allgemeine Elektrizitaets-Gesellschaft (AEG) (of Frankfurt/Main) unveiled a germanium rectifier unit for the simultaneous and safe charging of four large locomotive or truck batteries coupled up in parallel.

A feature of this unit is said to be the three charging phases comprising an initial charging period in which the current is held constant until the battery voltage reaches 2.4 v per cell. In the following phase, the voltage is maintained at 2.4 v per cell (±1%) at a decreasing charge amperage. During this period of charging any voltage fluctuations in the network up to a maximum of ±10% will be automatically compensated.

Over-all battery charging time has been substantially reduced by introducing a third phase whereby the charging current is held constant at the same time as voltage rises to 2.6v per cell.

Damage to the batteries during this third phase in the charging cycle has been avoided by providing a relay to automatically initiate the final charging stage only when the amperage fed to the four batteries has dropped to a value less than 20% of the five-hour battery discharge rate. The initial charging current is variable up to a maximum of 800 amp. **(51)**

Another first showing was a cyclone-type of mixer by Siebtechnik GmbH (of Mulheim/Ruhr). Though relatively new on the market, this machine is said to shine for its extremely thorough mixing of ingredients irrespective of whether these are in lump or pulverized form. A variable-speed drive allows the mixing speed to be adjusted accurately to the particular requirements of the mix constituents. **(52)**

In Germany, the problem of bundled or loose storage of pit props is still wide open. Two of that country's leading fork-lift truck manufacturers exhibited units for both storage methods. Maschinenfabrik Esslingen (of Esslingen/Neckar) featured a four-ton fork lift fitted with a slewable prop grab designed to lift a square yard of loose timber props to a maximum stacking height of about 19 ft. **(53)**

The Polytrac prop grab demonstrated by Bischoff (of Recklinghausen) is an all-hydraulic unit to lift brindled lots of props to a maximum stacking height of about 17.5 ft. The grab head can move sideways in both directions to eliminate any unnecessary maneuvering of the truck to bring it to the center of the prop bundle. The maximum weight lifted is two tons. **(54)**

Very few of the actual coal-getting machines shown at the Essen exhibition could be used or adapted to American requirements. Two outstanding exceptions are the continuous miner built by Korfmann (of Witten/Ruhr) and the 80-kw shearer-loader by Eickhoff (of Bochum).

The Korfmann continuous three-head boring miner is standardly fitted with two separate trim chains with the top chain designed for hydraulic lowering and raising while mining to give instantaneous control of the cutting height to follow any seam. This unit is probably the first continuous miner for cutting entries at 30-deg pitches. **(55)**

The Eickhoff shearer-loader demonstrated at Essen is fitted with an additional roof-cutting drum which can be hydraulically lifted and lowered to follow the course of the seam. The tungsten-carbide tipped picks on both drums plough out the coal which is flung onto a deflector plough before being dropped onto the face conveyor. Maximum cutting height of the upper drum is 7 ft with a 1-ft spacer inserted in the drum arm. **(56)**

Presently, it seems that nucleonics have made no great inroads into the realm of mining. The single use for isotopes demonstrated at the Essen exhibition was a radioactive device for controlling the level of sludge in settling basins. A height-adjustable radioactive source installed at one side of the settling basin directs a radioactive beam towards a height-adjustable counter on the opposite side of the basin.

Any interruption of the passage of rays across the tank due to the build-up of sludge will cause the counter to electronically switch on the sludge pumps to evacuate the basin. A further counter located vertically below the isotope at the lower end of the sludge discharge pipe is actuated as soon as sludge-free water flowing through the pipe allows an uninterrupted flow of radioactive rays between isotope and counter. Electronically, the counter then switches the sludge pumps off. **(57)**

Among the multitude of smaller auxiliary equipment and accessories, the Rolandwerk (of Oberhausen) featured a new type of self-lubricating belt pulley. Oil contained in the outer flange of the pulley bearing slowly seeps through a highly porous sinter-metal bushing located round the pulley spindle. The supply of oil in the tank is said to be sufficient for several years of uninterrupted operations. **(58)**

A new Radioskop by Total Geraetebau (of Mannheim) is enclosed in a flame- and explosion-proof housing to allow safe usage underground. In addition to the standard Geiger-Mueller counter, this improved type of unit has a scintillation counter for locating radioactive minerals. **(59)**

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Mining and Exploration

EXPLORATION by airborne methods and what they can do for you is the subject of a 10-page bulletin prepared by Hunting Geophysics. **(60)**

PICK-AIR PROSPECTOR method developed by Pick Laboratories is just one of the facets of a bulletin prepared by Vernon Pick's Enterprises. Pick says that the Pick-Air prospecting method can operate at $2.35 per mile as against $11.25 a mile for conventional methods. 34pp. **(61)**

DRILLING TOOLS—a new revised 24-page catalog (No. 358) containing all tools and complete specifications on Brunner & Lay carbide drill bits, drill rods and air tool accessories is available from the company. **(62)**

WATER WELL DRILLING with the Drillmaster and Downhole drill is fast, according to Ingersoll-Rand literature. One contractor put down 50 wells in granite to an average depth of 100 ft in three months. **(63)**

CONTRACT DRILLING services offered by Sprague & Henwood Inc. are discussed in a 19-page brochure. **(64)**

MODERN DIAMOND CORE DRILLS and their use aptly titles a bulletin (No. 7) prepared by E. J. Longyear Co. 8pp. **(65)**

ROOF BOLTS and accessories from Republic Steel Corp. are illustrated in an 8-page folder (ADV 998). **(66)**

'TENDAMATIC' — Ingersoll-Rand's new automatic compressor plant control system is featured in a 4-page flier (3259). **(67)**

TRACKWORK for industrial use and available from American Brakeshoe Co. Railroad Products Div. is illustrated in an 8-page release. **(68)**

FLEXIBLE METAL HOSE connectors catalog (658) from Cobra Metal Hose lists over 2,000 standard items. 16 pp. **(101)**

ADJUSTEX SHEAVE design introduced by Allis-Chalmers Mfg. Co. is available for A, B and C section belts in 2, 3 and 4-grove construction, according to one-page flier (2861). **(69)**

EXPLOSION - PROOF electrical equipment available from Crouse-Hinds Co. is described in 6-page release (2710). **(70)**

MOTORIZED GEAR DRIVE bulletin from Louis Allis Co. is four pages (No. 2350) and illustrates the new line of Line-A-Spede drives in double, triple and quadruple reductions for ratios up to 1487:1 with motor ratings of 1 to 75 hp. **(71)**

HEAT EXCHANGER motor (dc) designed to provide a wide adjustable speed range for constant speed applications in ratings from 25 to 300hp are presented in Louis Allis Co. bulletin (3000). **(72)**

REDUCED VOLTAGE starters in the Allis-Chalmers Mfg. Co. automatic line are discussed in a 12-page bulletin (2859). Included is motor control engineering for centrifugal compressors, hammer mills, pumps, conveyors, fans, motor generator sets, and other applications. **(73)**

POWER TRANSMISSION equipment in the T. B. Wood's Sons Co. line are introduced in an 8-page catalog. Covers sheaves, V-belts, flat belt pulleys, pillow blocks, flange units, take-up bearings, couplings and timing-belt drives. **(74)**

HOW TO GET longer life from V-belt drives is the title of a 12-page illustrated manual prepared by B. F. Goodrich Industrial Products Co. (IP-1577). **(75)**

INDUSTRIAL PIPING EQUIPMENT catalog available from National Cylinder Gas Div., Chemetron Corp. describes duplex, simplex, and portable manifold distribution systems for piping oxygen, hydrogen, nitrogen, etc. (N-125). 28pp. **(76)**

CEMENTED CARBIDES for the industry—tools, blanks and indexable insert for the machine shop—are set forth in a new catalog (C-16) prepared by Carmet, Allegheny Ludlum Steel Corp. 32pp. **(77)**

SLINGS bearing the MacWhyte label are cataloged in bulletin (5886) with specifications, load ratings and standard fittings for sizes ¼ to 1½ in. dia. 4pp. **(78)**

AIR FILTERS with throw-away filter cartridges (in 10-, 25- and 40-micron sizes) are one feature of Perfecting Service Co. bulletin (80). Also described are company line of air lubricators, humidifiers and regulators. 12pp. **(79)**

ILLINOIS GEAR—what it is and what it can do for you is the subject of a 12-page brochure prepared by Illinois Gear & Machine Co. **(80)**

FYRE-FREE fire-resistant clothing has been added to American Optical

E&MJ NOT GOOD AFTER JUNE 1, 1959

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1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

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16	32	48	64	80	96	112

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

Co.'s line of protective clothing. Clothing is 100% cotton cloth which is given a permanent flame-proofing. **(81)**

STANDARD STEAM COILS, steam distribution coils and hot water coils in the Herman Nelson Heating line of American Air Filter Co., Inc. are detailed in bulletin (890). 29pp. **(82)**

Metal and Mineral Processing

THERMISTOR-BASED temperature measurement and control instruments now available from Yellow Springs Instrument Co., Inc. are discussed in a 4-page brochure. **(83)**

HARDINGE ELECTRIC EAR—the automatic sentinel for grinding mills with a new sound recorder—is illustrated in a 4-page release (AH-480). **(84)**

METAL TUBE ROTAMETERS for measuring the rate of flow of hazardous and high-pressure fluids at temperatures up to 400 deg F are illustrated in a 4-page release (19A) from Schutte & Koerting Co. **(85)**

ROTAMETERS for pilot plant and laboratory use—in glass, plastic or metal piping—in ¼ through 2-in. sizes are presented in Schutte & Koerting Co. bulletin (18L). 2pp. **(86)**

HOW TO MEASURE the concentration of one gas in a multi-component mixture with Mine Safety Appliances Co. M-S-A Gas Thermatron is the subject of bulletin (0716-2). 4pp. **(87)**

PORTABLE BIN units in the Pioneer Engineering line store 6 cubic yd of material with extensions available to increase capacity to 10 yd, according to literature prepared by the company. **(88)**

RICHARDSON model MSM scale for bulk weighing of dry and free-flowing as well as sluggish materials is detailed in a data sheet prepared by Richardson Scale Co. (5807). 2pp. **(89)**

COAL BREAKER and crusher bulletin (658) from McNally Pittsburg gives the information on all their line of machines—rolls, rotaries, picks, etc. 36pp. **(90)**

ATOMIZED FERROSILICON PROduced by Knapsack-Griesheim and distributed in the U. S. by Westco Chemicals, Inc. is discussed in a 4-page reprint from the 1955 International Mineral Dressing Congress at Goslar. **(91)**

MOVIE ON JIGGING prepared by Western Machine Co. is available from the company on loan. History, theory and modern practice are covered, including the Wemco Remer jig. **(92)**

LIQUID-SOLID CYCLONE bibliography has been prepared by Battelle Memorial Institute specialists. Lists 243 articles on the subject from 1939 through 1957 and into 1958. **(93)**

HOW X-RAYS control a cement process is the subject of a reprint from *Rock Products* that may be obtained from Philips Electronics, Inc. 4pp. **(94)**

HOW THE VERTICONE makes for dust-free loading and unloading of all types of materials is the function of a 4-page bulletin prepared by Johnson-March Dust Control Engineers. Device sprays special Compound MR solution on material inside a specially designed conditioner and blender. **(95)**

POLLUTION CONTROL AID—the Aersol Membrane Filter developed by Gelman Instruments Co. for sampling dust particles in the atmosphere is thoroughly described in a 5-page report. **(96)**

LOGARITHMIC SLIDE RULE designed by Aluminum Co. of America to aid customers in selecting dimensions of aluminum foil or sheet for use in strip-wound electric coils is available on request. **(97)**

WALL CHART prepared by La Salle Steel Co. is 11x17 in. in size and lists all AISI grades of cold finished steel bars that are available. Five pages, lists 241 grades. **(98)**

BUYER'S GUIDE to sheet and strip steel lists types available for prompt delivery in coils, stock and cut-to-order sizes from Joseph T. Ryerson & Son, Inc. 8pp. **(99)**

PERLITE, and in particular the Seven Hills of Taos deposit—the world's largest deposit of commercial grade, according to the article, is discussed in F. E. Schundler & Co., Inc.'s 16-page brochure that describes the mining, processing and markets of this unique material. **(100)**

LOADING ASSEMBLIES for loading and unloading liquids from tanks, storage bins,and tank cars are illustrated in Jordan Industrial Sales Div., OPW Corp. 24-page catalog. **(111)**

PROCESS SAFETY RELIEF VALVES in the Farris Engineering Corp. line are detailed in a 44-page specification catalog (FE-118). **(112)**

Literature for Sale

BASIC PROCEDURES of soil sampling is a 67-page booklet prepared in non-technical language for general distribution by Acker Drilling Co., Inc., P. O. Box 830, Scranton 2, Pa. Includes preliminary or general survey sampling, detailed explorations, logs and records. Illustrated. Price $1. Write direct to the company, address above.

Plain Primacord Trunk Line. Is used also for shallow holes — wherever resistance to abrasion and cutting is not required. Textile covered, flexible, resilient, with a tacky non-slip surface. Tensile strength 125 lbs. — 1000 ft. spool weighs 18 lbs.

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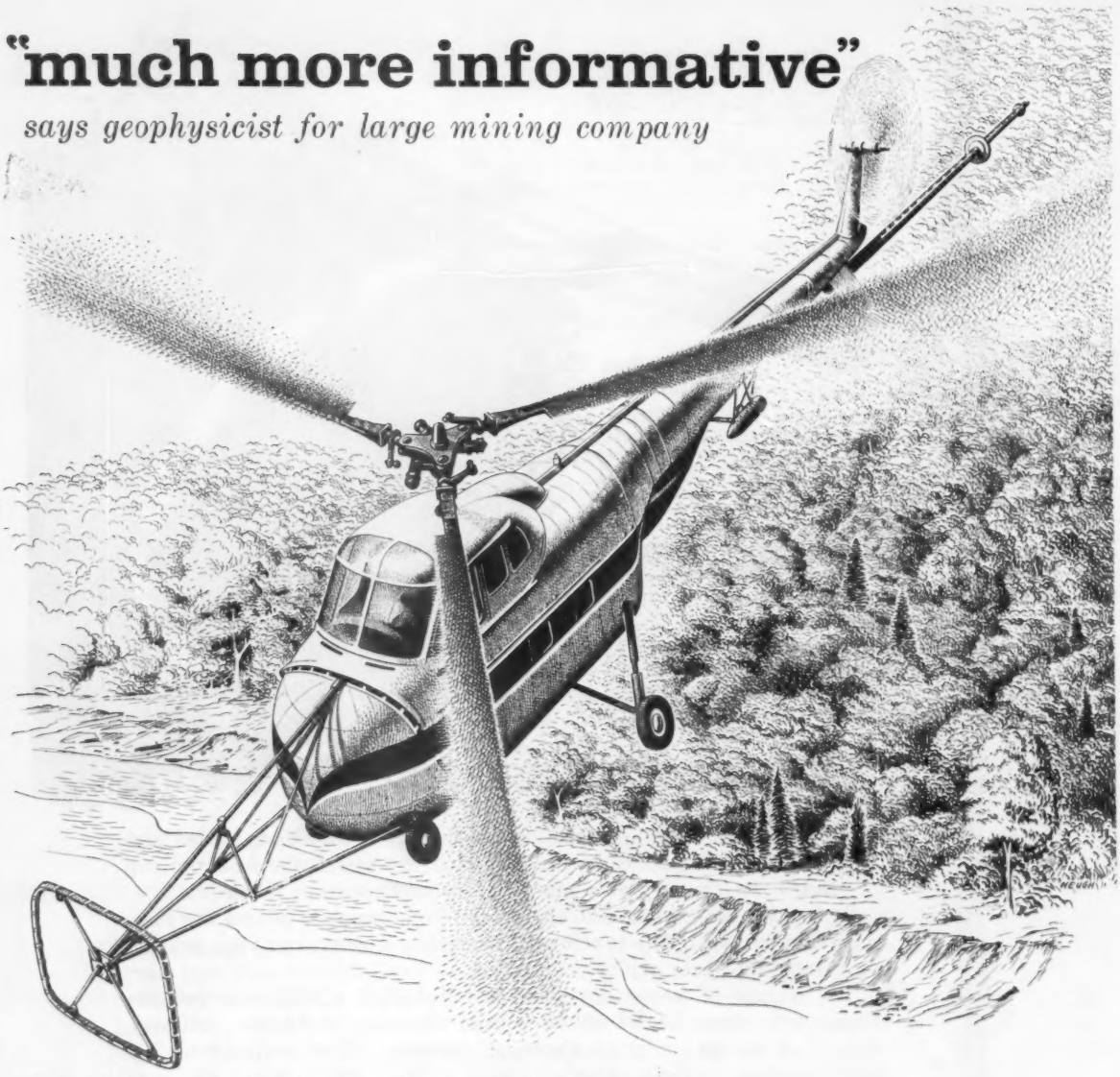

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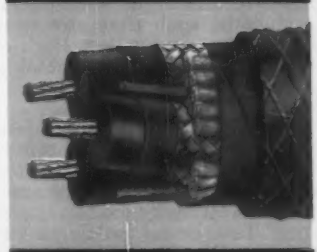

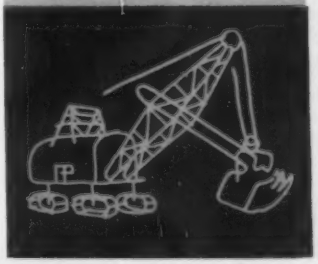

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H-W MAGNESITE

For the most strongly basic linings, this refractory, consisting predominantly of periclase (stabilized crystalline magnesia), fulfills the most severe requirements. It is fired at an extremely high temperature and is dense, strong and volume-stable at temperatures above the highest employed in copper furnaces. The unusually high magnesia content of H-W MAGNESITE, together with its outstanding physical properties account for the wide preference this refractory continues to gain for use in various metallurgical furnaces.

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Among basic refractories, Harbison-Walker METALKASE brick possess the property of maximum resistance to severe spalling conditions. METALKASE brick are furnished in various sizes and shapes. They are made in both chemically-bonded and hard fired basic refractories of various compositions which are widely used with particular benefit in suspended roofs and walls in the several types of metallurgical furnaces.

METALKASE XXP are chemically-bonded basic brick, formed under high pressure, with two internal plates. They are available in various compositions and in standard sizes, and suspended arch and other shapes.

STAR AND VEGA

These two superior silica brick now are made at seven widely separated Harbison-Walker plants. Shipments from these advantageous locations provide important savings in transportation time and cost.

STAR brand is regarded as standard for refining furnace bottoms and roofs at many plants. It is used in reverberatory Matte smelting furnace roofs and in a number of electric smelting furnaces of different designs.

VEGA is the original super-duty silica brick from which greatest benefit is derived in vulnerable positions where extremely severe operating conditions prevail.

for ALUMINUM furnaces

Refractories which are best suited for use in aluminum melting and holding furnaces possess properties which meet various specific requirements. In some furnaces the refractories in the bottoms are subjected to severe impact and abrasion. In the production of various alloys to meet certain rigid specifications, the refractories used must be such that any contamination, such as silicon pick-up, is avoided. High resistance to wetting and penetration by molten metal is paramount.

KORUNDAL

The unusual combination of desirable physical properties of this 90% alumina refractory makes it particularly adapted for use in bottoms and lower side walls. KORUNDAL is very strong and resistant to mechanical abuse, wetting by molten aluminum and to thermal spalling. This brand, made in modifications such as KORUNDAL DOT and KORUNDAL F, serves various specific needs to greatest advantage.

H-W SILICON CARBIDE

Some of the most important physical properties of this refractory are measurably enhanced by developments in manufacturing procedures. Many sizes and shapes are formed by impact under great pressure which accounts for increased density and strength. High temperature firing in a closely-controlled atmosphere contributes to the formation of an exceedingly impervious surface and lower permeability. It is unusually resistant to oxidation and wetting by molten metals and can be used in various furnace positions.

ALAMO

Along with other Harbison-Walker super-duty fireclay brick brands, ALAMO is favored for upper walls and roofs. Harbison-Walker products for aluminum furnaces comprise several other brands of high-alumina and high duty fireclay brick possessing the particular properties needed for best performance in this service.

BONDING MORTARS

HARWACO BOND (diaspore base), THERMOLITH (chrome base) and KORUNDAL BONDING MORTAR (stabilized alumina base), cold-setting high temperature mortars have unusually high strength for the temperature range of their use. While these may be used interchangeably for laying the various types of brick, each provides special benefits for particular applications.

H-W MONOLITHIC MATERIALS

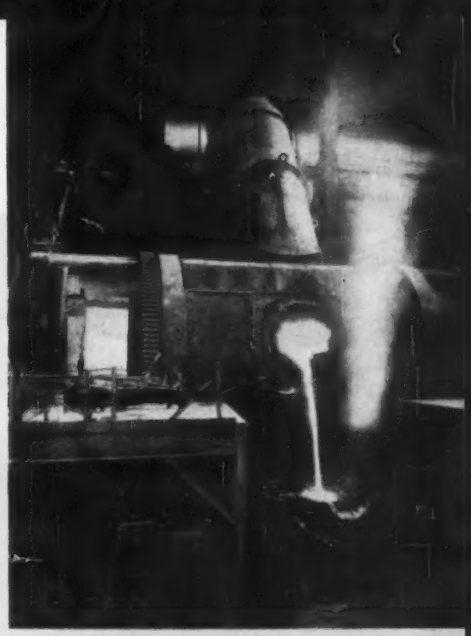
KORUNDAL RAMMING MIXTURE—H-W CHROME CASTABLE—H-W EXTRA STRENGTH CASTABLE and H-W PLASTIC FIRE BRICK among the full complement of Harbison-Walker monolithic refractories are especially adapted for aluminum furnaces. They are favored in this industry because of the pronounced properties of volume stability, low thermal expansion and high resistance to both penetration and abrasion.

H-W ZIRCON

This zirconium silicate refractory made by impact under high pressure in various rectangular sizes is exceedingly dense, impervious and resistant to wetting by molten aluminum. Because of its spendid workmanship, it can be laid with very thin joints of H-W ZIRCON BONDING MORTAR which is especially desirable for side wall construction.

REFRACTORIES

for dependable performance in every metallurgical operation



for OTHER NON-FERROUS furnaces

The service conditions in furnaces employed in the numerous non-ferrous metallurgical processes vary widely, and the refractories must meet highly specialized requirements. The selection of the proper refractory frequently governs the degree of success of the processes employed in the reduction, refining and melting of these metals. Harbison-Walker products comprise all the different types and classes of refractories needed for all the metallurgical processes, such as for the reduction and refining of nickel, lead, zinc, tin and other metals.

Extensive research and experience govern the selection of the particular Harbison-Walker refractories which serve best in metal chloride furnaces such as those used for making titanium and zirconium chlorides and for the production of metallic sodium and magnesium. Brands generally favored for these requirements are VARNON BF, H-W MULLITE and DURO.

SOME OTHER H-W BASIC REFRACTORIES

The superior performance of Harbison-Walker basic refractories is the result of a thorough knowledge of the requirements, extensive and continuous original research conducted by the Harbison-Walker Research Department, and highest quality raw materials processed in modern plants under close laboratory control.

CHROMEX
—a chemically-bonded chrome-magnesite brick having excellent spalling resistance.

MAGNEX
—a chemically-bonded magnesite-chrome brick—highly basic and of low spalling tendency.

H-W CHROME
—a hard burned chrome brick especially adapted for various specific uses.

FORSTERITE
—the only commercially produced magnesium-silicate brick—suited for certain particular applications.

H-W PERIKLASE
—an exceptionally high magnesia brick of unusual high-temperature stability.

H-W INSULATING REFRACTORIES
—all classes of insulating brick, castables and block insulation from which to select those best suited for each precise requirement.

RAMMING MIXTURES, GRANULAR REFRACTORIES, CEMENTS AND CASTABLES

H-W MAGNAMIX . . . H-W C MIX . . . H-W WASHINGTON DEAD BURNED MAGNESITE GRAINS . . . H-W WASHINGTON FURNACE MAGNESITE . . . H-W SPECIAL FURNACE CHROME . . . DRY and PLASTIC THERMOLITH BATCH (Plastic Chrome Ore) . . . H-W PLASTIC FIRE BRICK . . . H-W Castable Refractories of all classes including those of basic composition, i.e. HARCHROME, CHROMEPAK and H-W PERIKLASE Castable.

The outstanding records made by Harbison-Walker refractories are due to the most modern and efficient manufacturing facilities, the full complement of types and classes, and the closely controlled high quality of the products.

Harbison-Walker's technical staff stands ready to assist in the selection and application of refractories that will serve dependably and economically.

Harbison-Walker Refractories Company
AND SUBSIDIARIES
World's Most Complete Refractories Service
General Offices . . . Pittsburgh 22, Pennsylvania

Where the going gets rough...

get tough

with Lukens "T-1" Steel!

TRADE-MARK

LUKENS ®

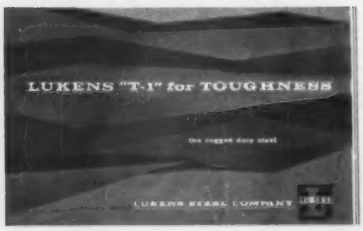
■ Wherever rock and gravel, coal and ores come in violent contact with machine and equipment parts, Lukens "T-1" steel—*especially extra tough 321 min. BHN quality*—fights back at wear and abrasion with spectacular success.

It is readily fabricated. You can form or weld it in the field or shop, from stock plate sizes immediately available. It can be used to replace or repair worn bucket teeth, truck and mine car bodies or liners, dozer blades, dipper sticks, crusher teeth, chutes, and many other parts.

Far stronger for its gage than conventional steel, it requires less metal to do equivalent jobs. It remains tough even at sub-zero temperatures.

Contact your nearest warehouse listed below, or write Manager, Marketing Service, 143 Lukens Building, Lukens Steel Company, Coatesville, Pennsylvania. Ask for special bulletin, *"Lukens 'T-1' for Toughness."*

WRITE FOR THIS BOOKLET TODAY



WAREHOUSES

Ashland, Kentucky, Mansbach Steel Co., 19th St. & River Front

Baltimore 2, Maryland, Wm. G. Wetherall, Inc., 317 President Street

Birmingham 2, Alabama, O'Neal Steel, Inc., P. O. Box 2623

Cleveland 6, Ohio, Mills-Wolf Steel Co., 10006 Carnegie Avenue

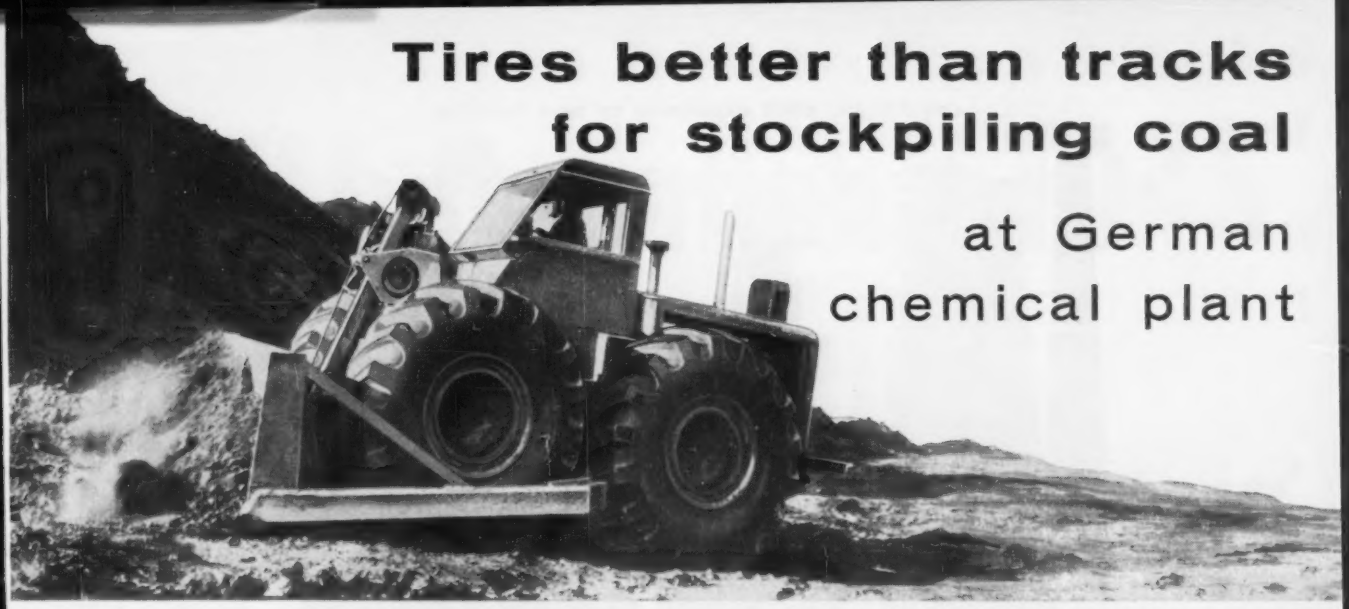
Los Angeles 33, California, The R. J. M. Company, 238 Mission Rd.

Montreal, Quebec, Can., Drummond, McCall & Co., Ltd., 930 Wellington St.

HELPING INDUSTRY CHOOSE STEELS THAT FIT THE JOB

Tires better than tracks for stockpiling coal

at German chemical plant



At Chemische Werke Huls A. G., in Marl, near Recklinghausen, Germany, a Tournatractor® has been stockpiling coal for the past four years.

Coal is unloaded from railroad cars by clamshell bucket . . . dumped along two rail sidings. The 210-hp, rubber-tired Tournatractor dozes coal away from the tracks to the end of the stockpile.

When this plant was visited, Tournatractor had built the stockpile to a height of 32 feet, a width of 260 feet.

In reporting on Tournatractor's performance, it was noted that for coal stockpiling work, rubber tires were preferable to crawler tracks.

Study this production chart

According to accurate records, kept for an 8-hour shift, the Tournatractor dozed coal into place at the following rate:

Stockpiling production per hour

Distance	Volume	Tons
32 ft	523 cu yd	395
65 ft	313 cu yd	240
164 ft	189 cu yd	140
328 ft	124 cu yd	93

Over short operating periods, it was reported this production could be increased by about 25%.

Compacts coal as it dozes

Tournatractor's big, low-pressure tires ride easily over stockpiles without breaking the coal, or grinding it to powder — as the steel tracks of crawlers do.

CT-1654-IJ-1

As Tournatractor dozes coal into place, its large, low-pressure tires also compact material . . . forcing out sub-surface air pockets that could easily cause spontaneous combustion.

Works 5400 hours, no big repairs

Working constantly in coal and coal dust for well over 5400 hours, Tournatractor never needed major repairs . . . always gave reliable service. At the end of this time, owners say equipment and tires were still in good condition.

Tournatractor operating costs, including operator's wages and depreciation, averaged $7.16 per hour.

Compare Tournatractor with your present yard rigs

Power plants all over the world now handle coal stockpiling, bunker loading, and clean-up work with fast modern Tournatractors . . . at big savings over other methods and machines.

Find out what Tournatractor can do. Check its many work applications.

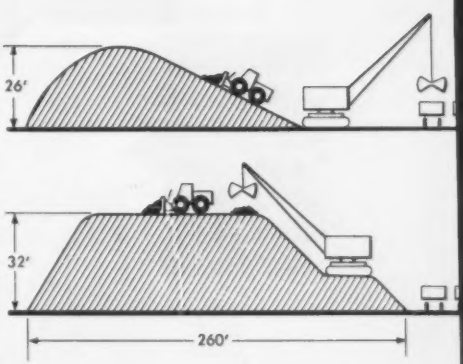


Diagram shows a cross-section of the coal stockpile Tournatractor maintains. In the upper sketch, made early in operations, stockpile measured only 26 feet high. Note that in the later drawing below, clamshell bucket is working on a shelf on the stockpile, at some distance above railroad track at right.

Then compare Tournatractor's performance with that of units now dozing, hauling, and switching cars on your jobs. Better yet, ask for a Tournatractor demonstration on your job.

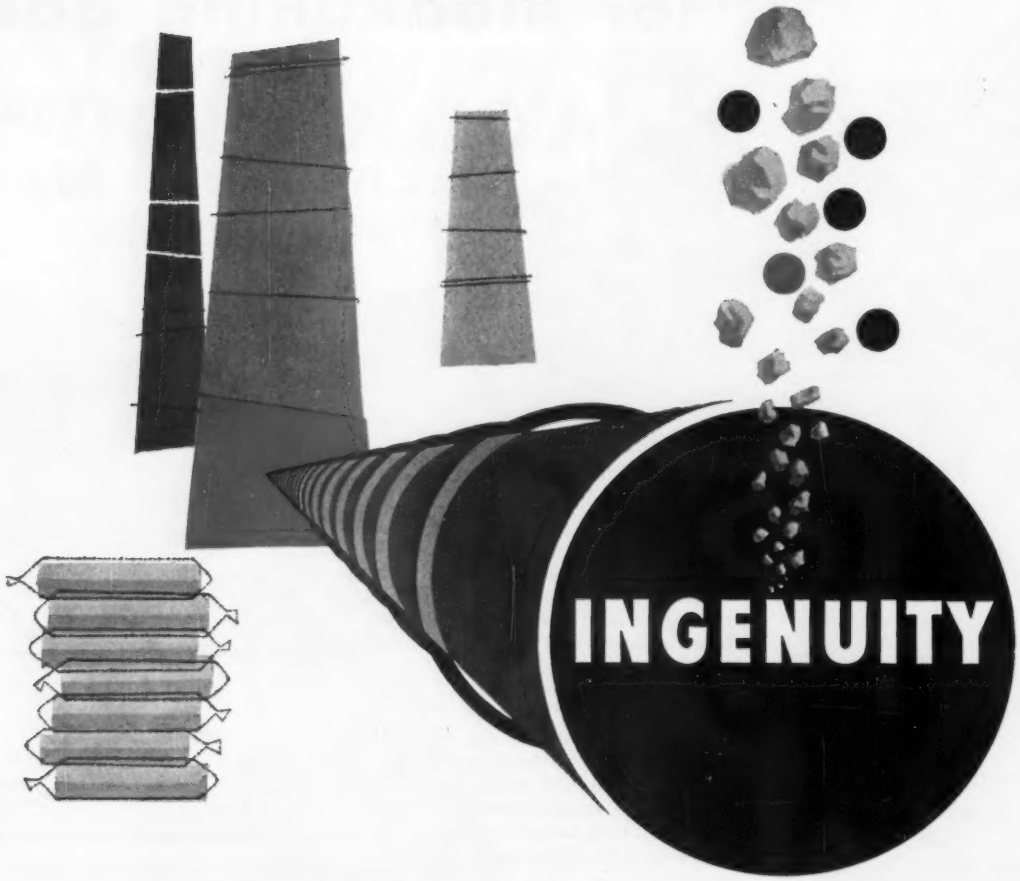
At this plant in Germany, Tournatractor dozes coal delivered by rail, away from the tracks to build up a large stockpile. At times, however, Tournatractor dozes coal back to the rail line for reloading. Tournatractor can also be used to haul a scraper for transporting coal, or, equipped with a railroad coupler attachment, it can handle yard switching work.

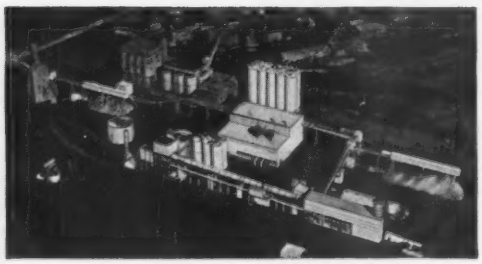
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

call KE for plant expansion or new facilities





1,250,000 barrel cement plant addition recently completed by KE for Marquette Cement, one of world's largest cement producers.

has made KE a major engineer-contractor serving the Minerals Industry

Placing of four fully-lined mills in a few hours instead of days—a unique center pier kiln drive —a 2,700' cement transport "airway." With these and many more planned innovations and short-cuts, Kaiser Engineers completed Marquette Cement's Cape Girardeau plant expansion quickly and economically. Construction cost and time were well below industry average.

Mining, transportation, beneficiation, materials handling, processing in cement, gypsum, coal, ferrous and non-ferrous metals facilities—these are but a few of the fields wherein KE serves the Minerals Industries—from economic analysis through start-up.

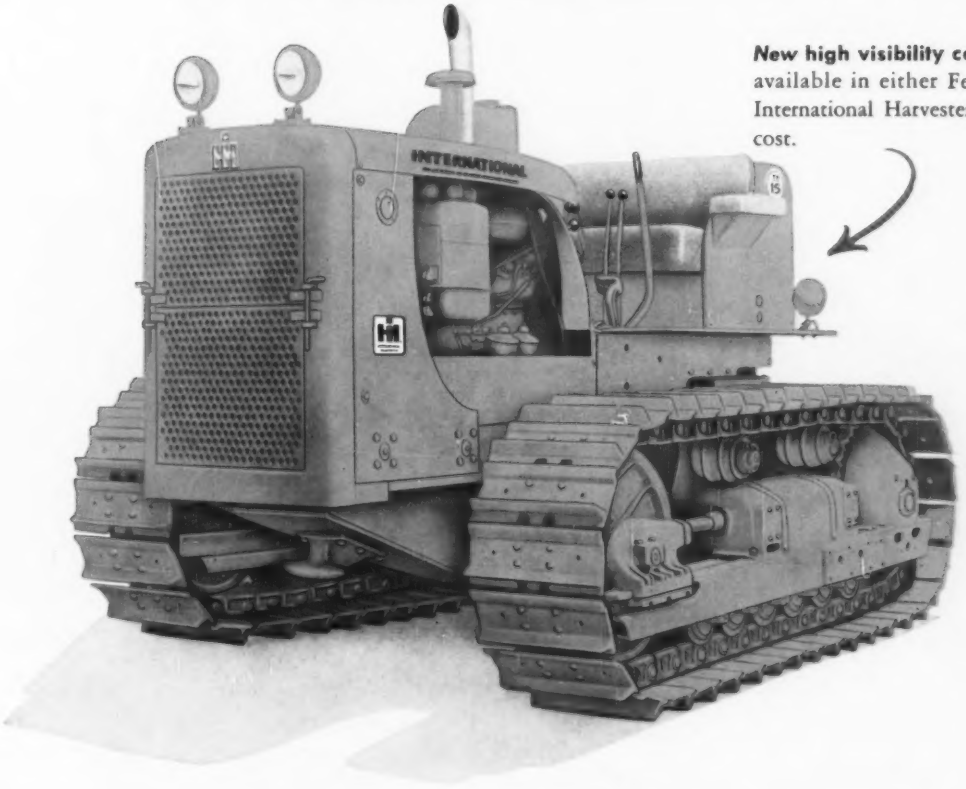
KE ingenuity—multi-industry experience, keenly applied—can benefit your next facility. Let us show you how.

KAISER ENGINEERS engineers—contractors
Contracting since 1914

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

NEW International® TD-15 tops 100-hp field...

with exclusive power and control features!



New high visibility color. Optionally available in either Federal yellow or International Harvester red at no extra cost.

NEW

6-cylinder diesel power . . . 105-hp fully-proven D-554 engine—full 20,500 lbs drawbar pull.

NEW

6-speed full-reverse transmission . . . 20% higher reverse speeds. A speed for every work or travel need plus fast "Shuttle-Bar" direction changing!

NEW

Precision control

Foot Decelerator for instant speed changes —fast "Shuttle-Bar" forward-reverse travel.

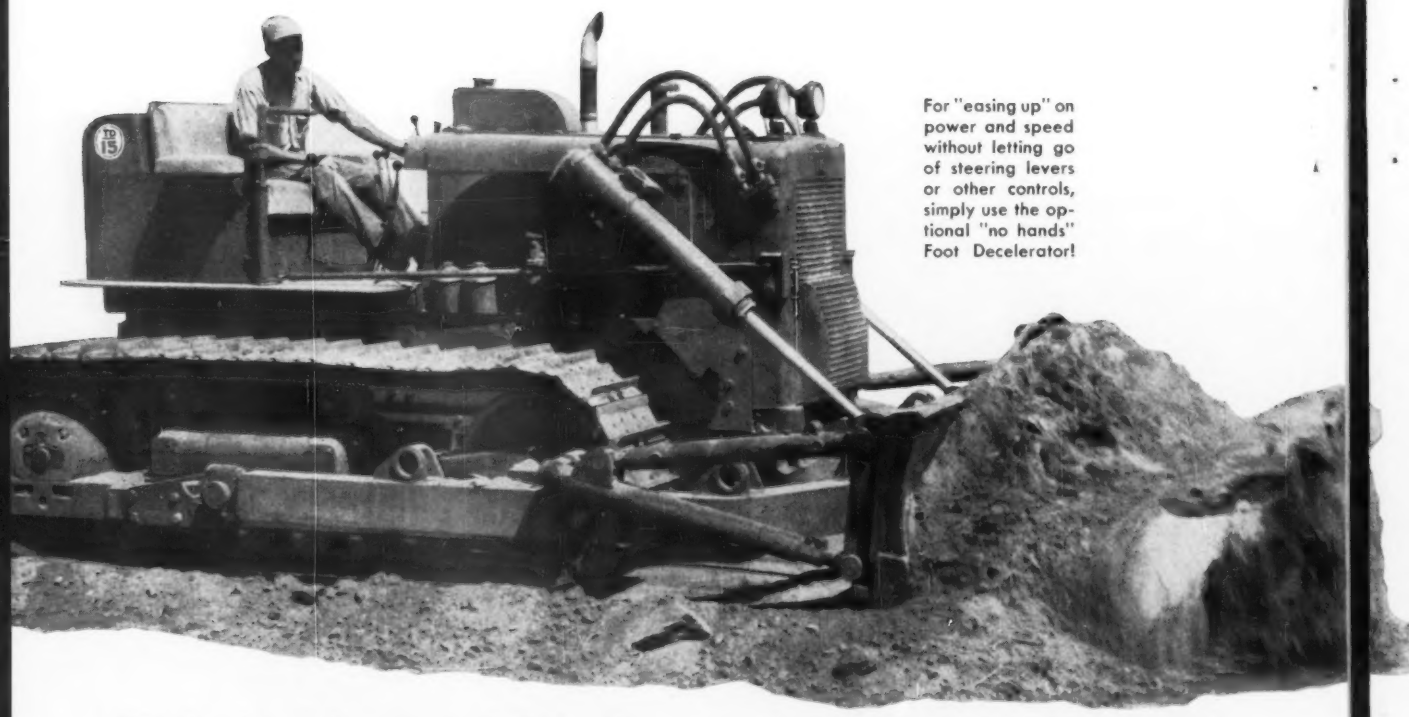
NEW

1,000-hour lube interval, heavy-duty track rollers

. . . heavy-duty, long-life bushing type, with extra capacity lube reservoir.

...and here's the pay-off for you...

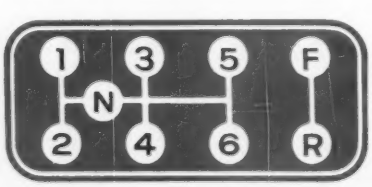
You move in on...and speed up
....with NEW TD-15



For "easing up" on power and speed without letting go of steering levers or other controls, simply use the optional "no hands" Foot Decelerator!

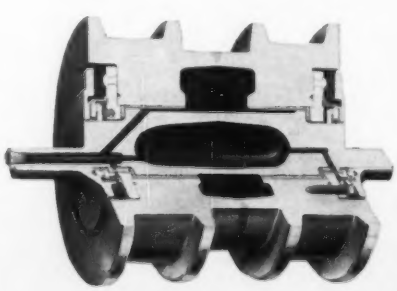
Exclusive six-speed "single stick" shift . . . forward and reverse "Shuttle-Bar"

You shift through all six speed ranges of the new TD-15—forward or reverse—with a single lever. Shift pattern is planned for gear-changing ease and speed with a fast sweep of the hand—to give you instant use of the speed you need. To speed the work-cycle and take full advantage of fast shifting, you simply push or pull the "Shuttle-Bar"—to change TD-15 forward or reverse instantly.



1,000-hour lube interval, heavy-duty, track rollers

Not just another "claim" . . . International now combines heavy-duty *bushing design*, exclusive cartridge-type *metal-to-metal seals*, and king-size lube reservoirs, to offer the industry the first heavy-duty type roller as standard equipment on the TD-15. Thick shells for safe build-up and exclusive pressure relief passages for flush-out and prevention of seal damage from power lubricators are part of this new design.



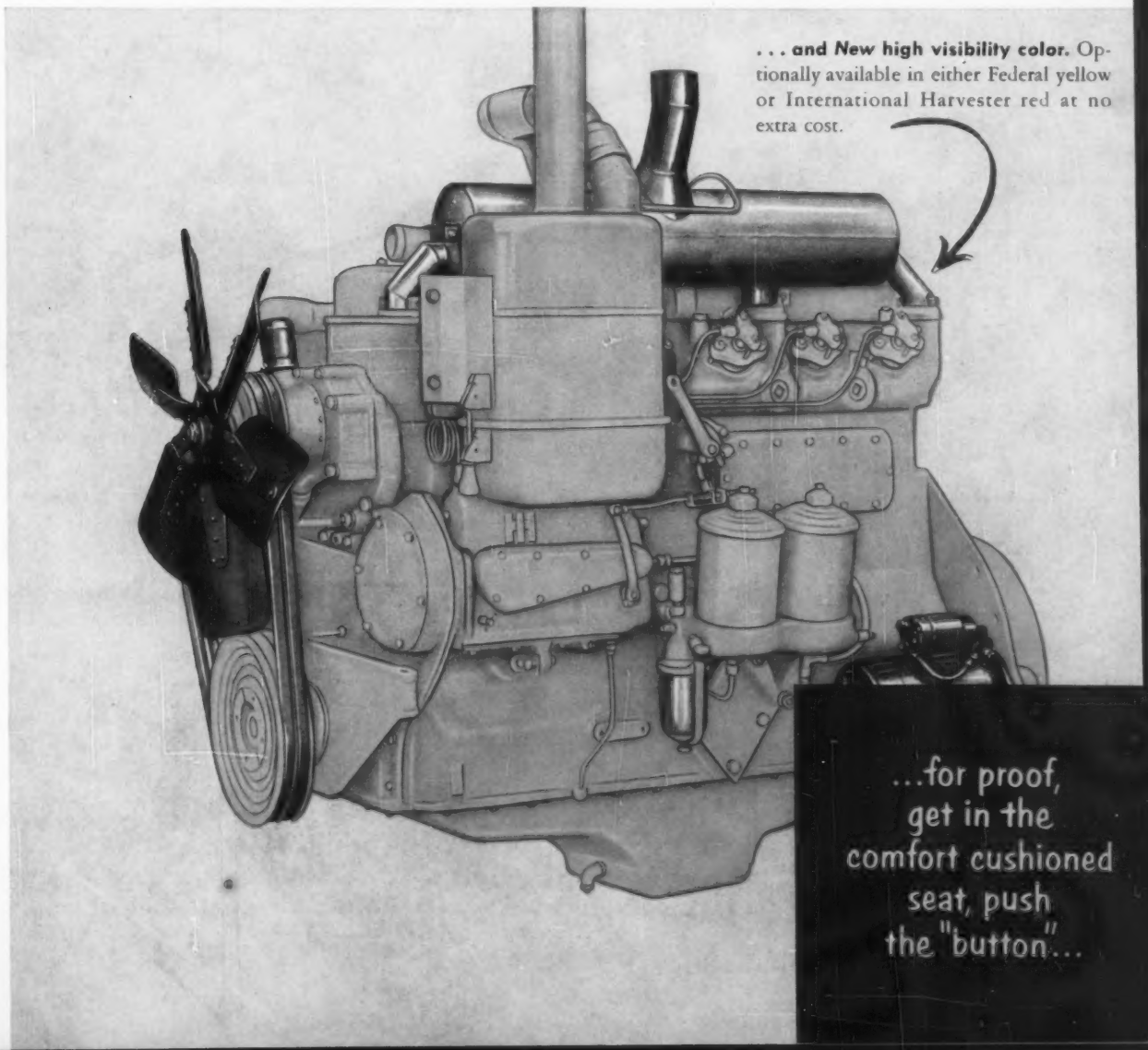
...a whole new range of jobs...

capacity and control

Smooth 6-cylinder... BIG 105 IH diesel horsepower

You get 6-cylinder smoothness from this new International D-554 diesel engine that powers the new TD-15. This fully-proven power plant produces its 105 net hp at 1,650 rpm . . . features famous International 45-degree angle operation full-flow lubrication, closed pressurized cooling, exclusive twin plunger pump fuel injection system, fully counter-balanced crankshaft, positive valve rotators, and all-weather gasoline conversion starting. Here's an engine built for long life, big-capacity output!

New power, strength, control, and reliability features like these show you how and why the 105-hp TD-15 tops its field. You move in on a new range of heavy jobs—material-moving, land-clearing, hauling, loading, excavating, logging, mining—that no longer belongs to next-size-bigger crawlers!



. . . and *New* high visibility color. Optionally available in either Federal yellow or International Harvester red at no extra cost.

...for proof, get in the comfort cushioned seat, push the "button"...

Compare TD-15 performance to anything *in the 100 hp crawler field!*

Prove to yourself you can move in on, and speed up, a whole new range of heavy jobs—with new TD-15 capacity and control. Put the TD-15 through its paces—compare *power*, *speed*, *capacity*, and *control* to anything else on tracks in the 100 hp field. The 6-speed full-reverse transmission and "Shuttle-Bar" will show you on-the-job how fast, easy, and profitable shuttle-cycle operations can be! Press the decelerator and see what a helper this feature can be for actually speeding up operations—by reducing declutching and shifting time! Measure sintered metal, dry-type clutch full power transfer efficiency and maintenance, ease and economy to any other crawler's clutch—wet or dry! See your International Construction Equipment Distributor for a new TD-15 demonstration!

International® **Construction Equipment**

International Harvester Co. • 180 N. Michigan Ave. • Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

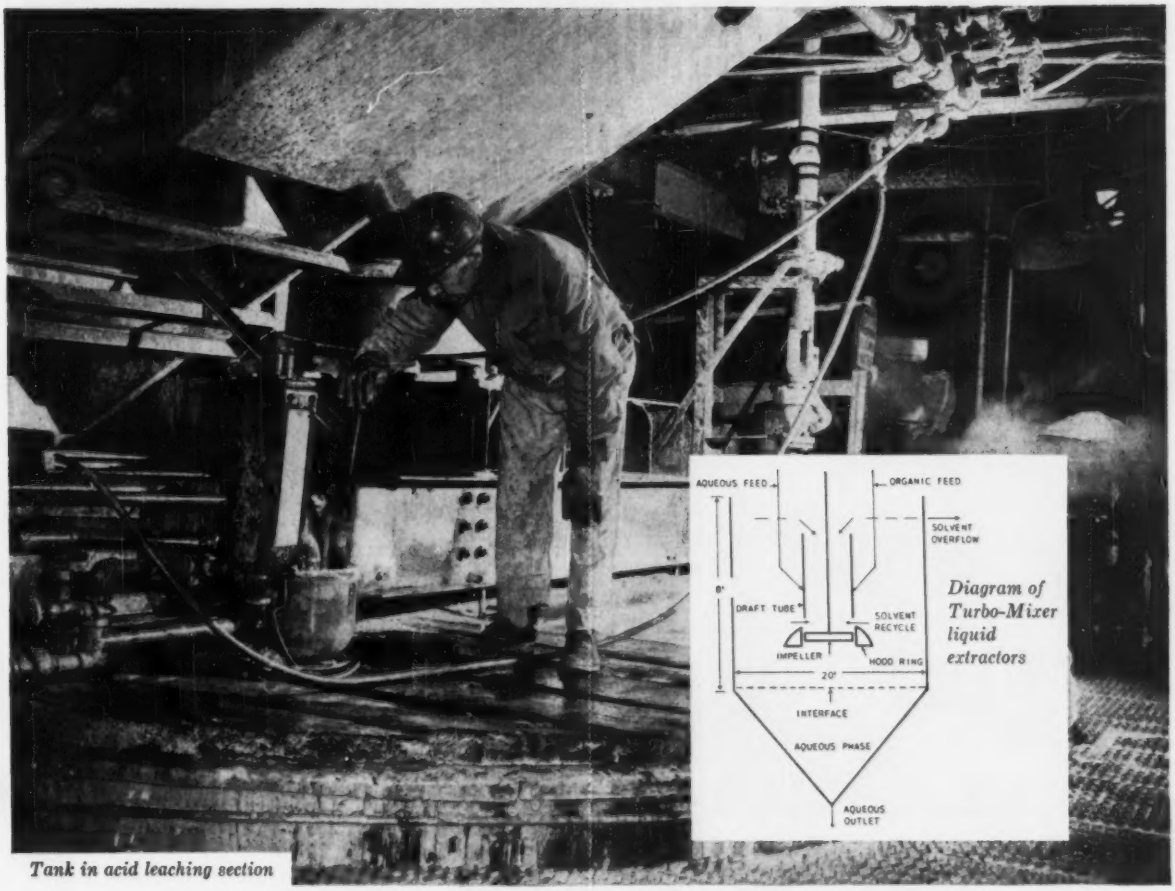


Diagram of Turbo-Mixer liquid extractors

Tank in acid leaching section

VITRO URANIUM HANDLES A WIDE VARIETY OF URANIUM MINERALS WITH TURBO ON THE JOB

When VITRO URANIUM COMPANY of Salt Lake City embarked on a modernization program, they called on GENERAL AMERICAN to assist in the design of the most modern mill possible.

Heart of the plant is the extraction system, and here, GENERAL AMERICAN Turbo-Mixers proved to be key equipment, in both the leaching and liquid extraction sections.

VITRO URANIUM processes a wide variety of uranium minerals which require highly versatile extraction equipment. GENERAL AMERICAN Turbo-Mixers fit this requirement, replacing an outmoded phosphate precipitation operation. Recoveries of uranium fed into the system are "excellent."

As a result of VITRO'S million and a half dollar modernization program, the 660 ton/day mill already has significantly reduced operating costs. Further proof that in processing as in transportation and storage, it pays to plan with GENERAL AMERICAN.

FOR DETAILED INFORMATION AND USEFUL DESIGN DATA, SEND FOR THE FOLLOWING BULLETINS:

Please send me the following Turbo-Mixer Bulletin (s) :

General Turbo-Mixer Bulletin_____

RDC Extraction Column Bulletin_____

Side Entering Propeller Mixer Bulletin_____

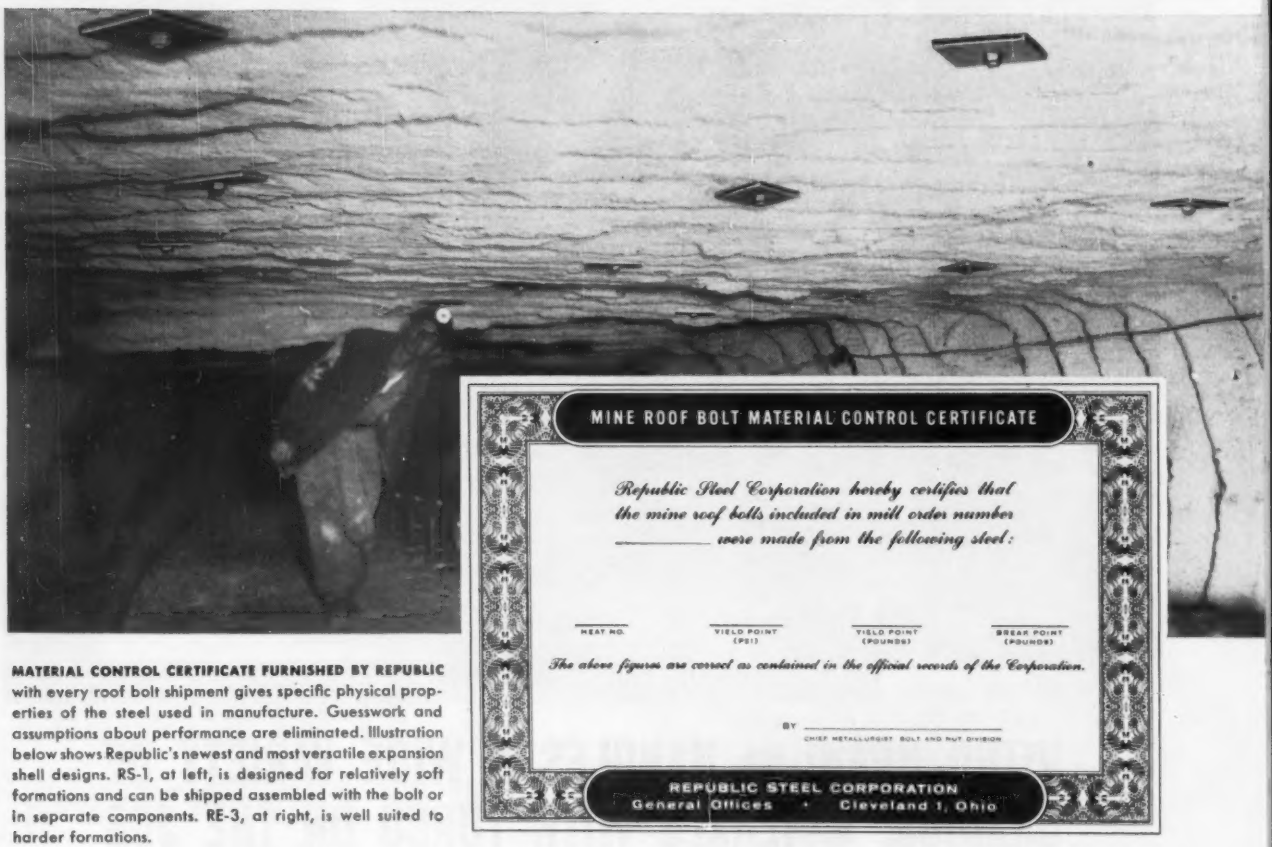
Absorption & Oxidation Bulletins_____

TURBO-MIXER DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION

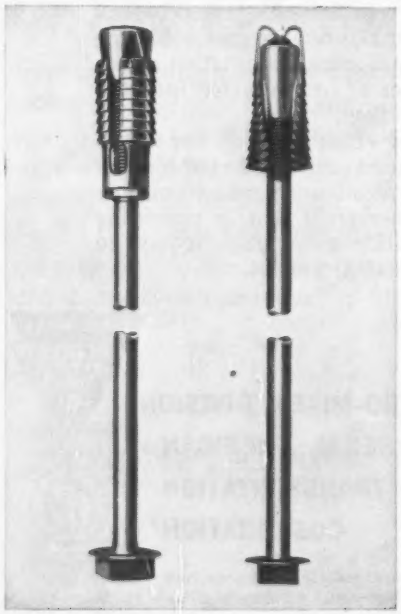
Sales offices: 380 Madison Avenue, New York 17, New York • General Offices: 135 South LaSalle Street, Chicago 90, Illinois • Offices in principal cities

CERTIFIED STEEL ASSURES SUPERIOR STRENGTH

In Every Republic Roof Bolt Sold


MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE
Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:
HEAT NO.
YIELD POINT (PSI)
YIELD POINT (POUNDS)
BREAK POINT (POUNDS)
The above figures are correct as contained in the official records of the Corporation.
BY _____
CHIEF METALLURGIST, BOLT AND NUT DIVISION
REPUBLIC STEEL CORPORATION
General Offices • Cleveland 1, Ohio

MATERIAL CONTROL CERTIFICATE FURNISHED BY REPUBLIC with every roof bolt shipment gives specific physical properties of the steel used in manufacture. Guesswork and assumptions about performance are eliminated. Illustration below shows Republic's newest and most versatile expansion shell designs. RS-1, at left, is designed for relatively soft formations and can be shipped assembled with the bolt or in separate components. RE-3, at right, is well suited to harder formations.



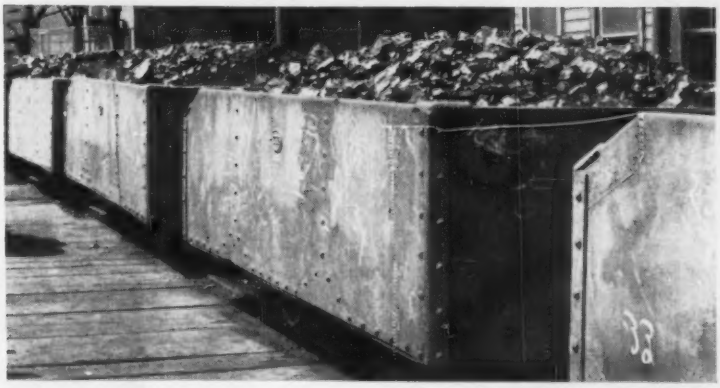
No matter what roof-bolting problems you face, in high or low roof areas . . . hard or soft formations, Republic Roof Bolts offer a combination of advantages unmatched by any other manufacturer to assure maximum top-holding reliability. Not the least of these advantages is Republic's exclusive Material Control Program, plus the most complete selection of roof bolts on the market.

Because Republic is an integrated steel producer, the Material Control Program actually extends from mining and blending of raw ores to finished roof bolt production. Key element in this procedure is a series of physical tests which every heat of steel used in roof bolt manufacture must pass. Test results entered on Material Control Certificates, accompany all shipments as direct evidence that Republic Roof Bolts meet or exceed the physical properties standards approved by the American Mining Congress and American Standards Association.

In addition to laboratory-certified steel, all Republic Roof Bolt Assemblies are backed by the findings of extensive field performance tests conducted in Republic's own mines. As a result of these studies, only Republic offers proved assemblies in all four major classifications. Moreover, this experience enables Republic impartially to recommend the type or types best suited to conditions in your mine, along with suggested methods of placement and spacing.

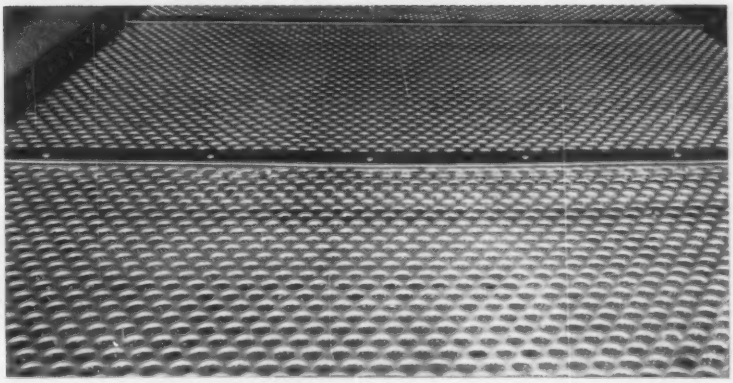
For complete information on certified-strength Republic Roof Bolts, contact your Republic representative or mail coupon.

MANY SUPERIOR FEATURES OF REPUBLIC'S NEW TRUSCON STEEL BUILDINGS contribute to their economical performance in mining applications. All parts are delivered in a complete package, including roofing, siding, windows, doors, and hardware, ready for fast, easy erection. Available in 32-, 36-, 40-, 44-, and 48-foot widths, 12- and 14-foot heights, and any required lengths, these Truscon "Budget Buildings" are ideal for personnel, equipment, or material shelter. Roofing and siding are galvanized to eliminate painting. Buildings can be dismantled and stored or re-erected to meet changing needs. Send coupon for details.



SUPERIOR STRENGTH PLUS CORROSION-RESISTANCE are two of the many features of Republic High Strength Steel which make it ideal for a wide variety of mine industry applications. In mine car and hopper car use, for example, these factors contribute to greatly reduced maintenance. Republic High Strength Steel also provides good impact and abrasion-resistance. It will pay you to evaluate all of these advantages in terms of your equipment performance specifications. For more information, mail coupon.

SUPERIOR PERFORMANCE OF REPUBLIC ENDURO® STAINLESS STEEL used for this cleaning plant shaker screen has drastically reduced replacement expense. Reason is ENDURO'S excellent resistance to abrasion and corrosion. Other characteristics of ENDURO which pay service dividends in mine equipment applications include its good strength-to-weight ratio, easy cleanability, and high impact strength. In addition, ENDURO is readily formed and welded, simplifying both manufacturing and maintenance operations. Mail coupon for data.



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World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
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1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ Mine Roof Bolts ☐ Truscon Steel Buildings
☐ High Strength Steel ☐ ENDURO Stainless Steel

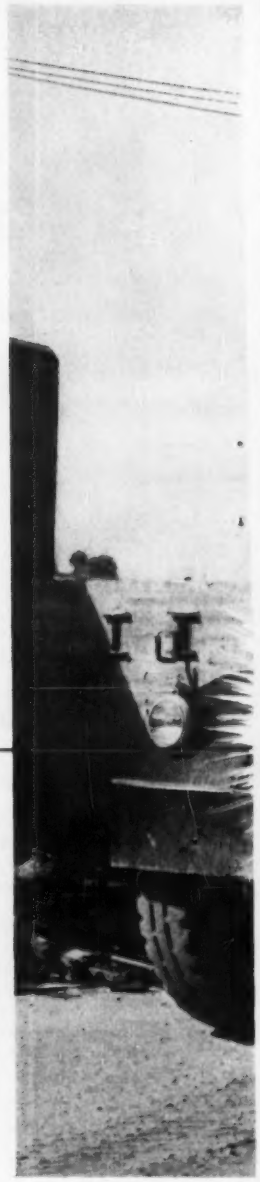
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

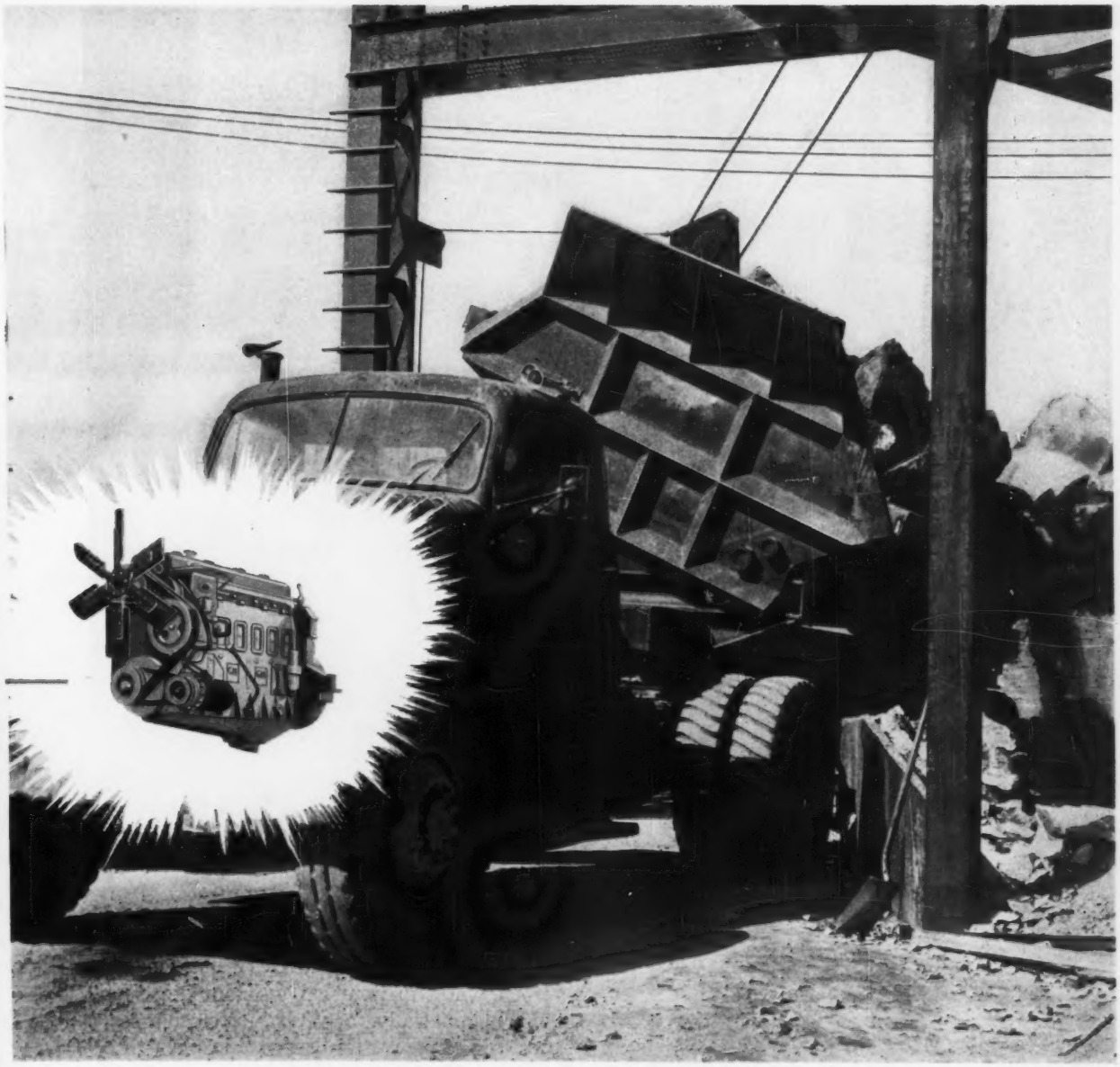
"JIMMY" DIESEL ENGINE SUCCESS!



A little over a year ago, the "Jimmy" Diesel was made available for any make of truck—now it is offered in trucks built by 8 important manufacturers!

Detroit Diesel Engine Division of General Motors,

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario · Regional Offices: New York, Atlanta, Detroit, Chicago, Dallas, San Francisco



Secret of this success is the fact that the GM "71E" engine is outperforming all others on the highway—producing the lowest-cost miles in history! Ask for "Jimmy" Diesel power when you are in the market for new trucks. And write for brochure describing new *lightweight* version of "6-71E" engine—weighs up to 690 lbs. *less* than competitors in the 210 h.p. range.

HERE'S HOW A "JIMMY" DIESEL FITS YOUR TRUCK.

Load	Model	Horsepower
35-45,000 GCW	4-71E	140 gross HP @ 2100 RPM
40-60,000 GCW	4-71T*	171 gross HP @ 2300 RPM
50-76,800 GCW	6-71E	210 gross HP @ 2100 RPM
60,000 GCW and up	6-71T*	236 gross HP @ 2100 RPM

*GM Turbopower Diesels—higher power with little increase in size or weight.

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Single Engines...30 to 364 H.P. • Multiple Units...Up to 893 H.P.

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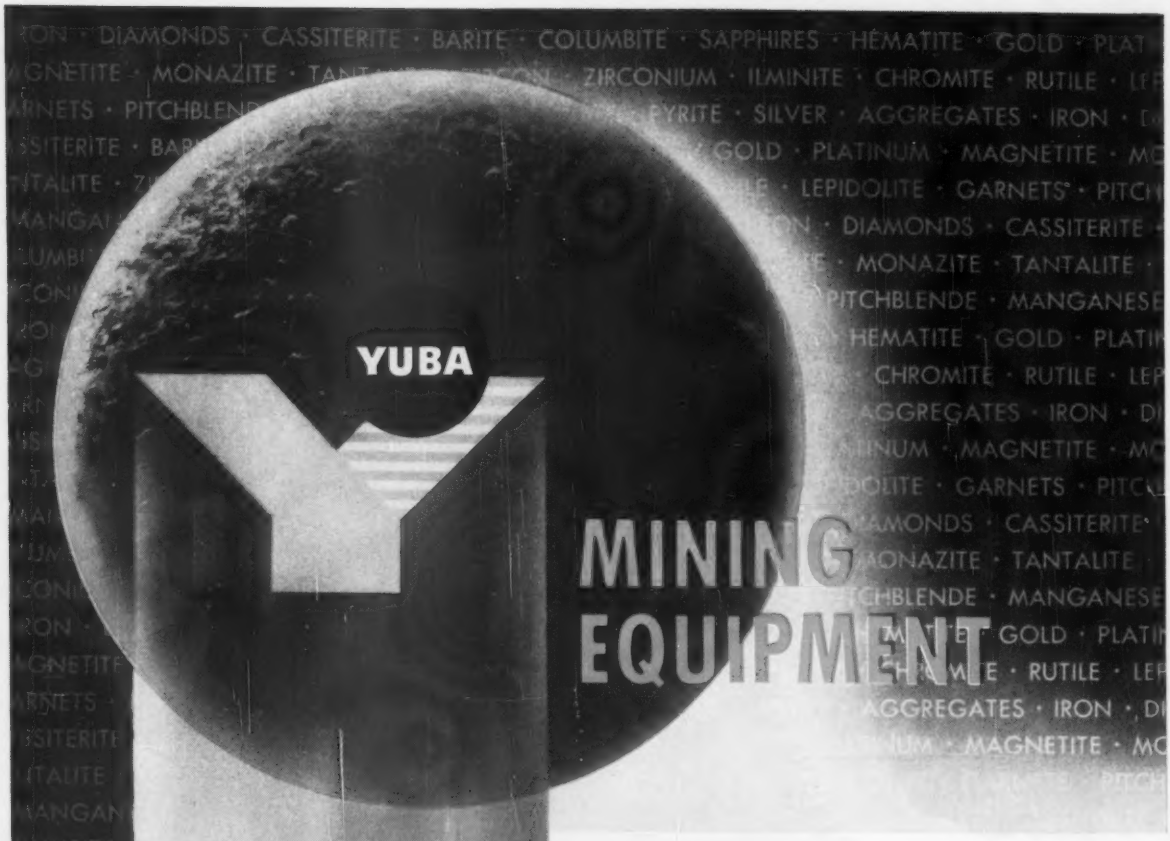

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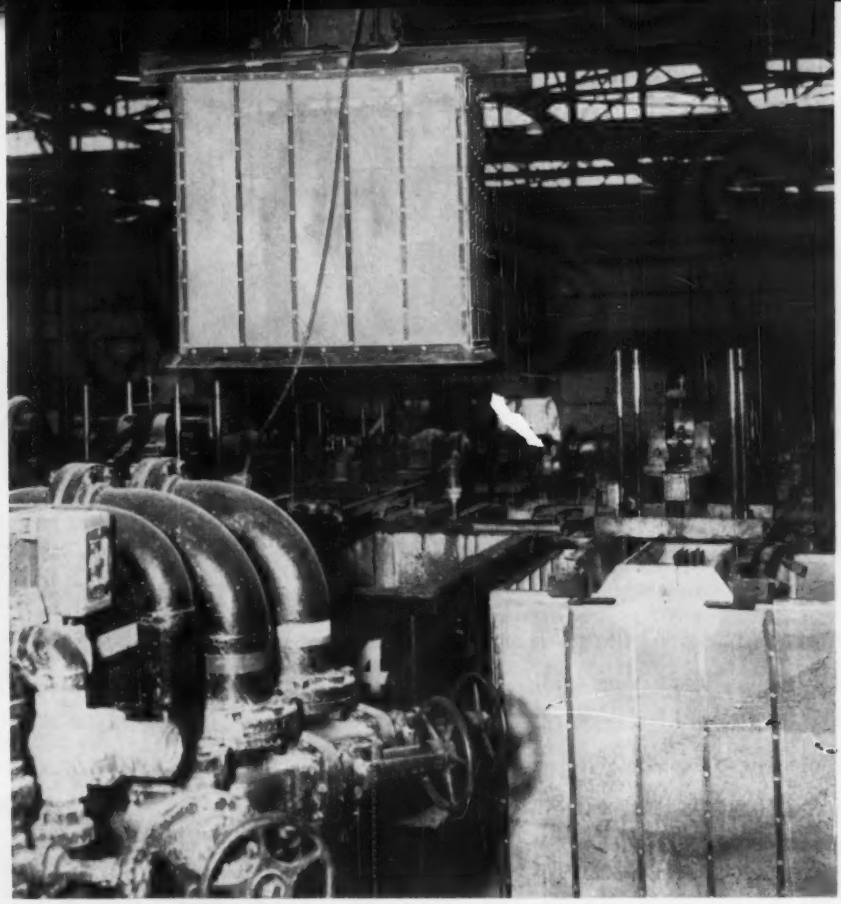

Stainless Steel baskets containing ion exchange resins. Adhering sulfate ions are stripped with ammonium nitrate solution.

Stainless Steel passes acid test

at Anaconda's uranium acid leaching plant in Bluewater, N. M.

You've probably read about Anaconda's Bluewater plant. It processes all the ore from the famed Jackpile Mine about 60 miles away.

The plant uses a lot of Stainless Steel—but none of it is replacement Stainless. Using pilot plant data, and a solid background of chemical ore processing knowledge, Anaconda engineers designed with Stainless Steel right from the drawing board. Stainless was selected wherever resistance to acid and abrasion was needed, and in the words of Anaconda engineers, "Nothing else could do the job so inexpensively."

The process starts by treating the ground ore slurry with sulfuric acid, so Type 316 Stainless Steel was chosen for the piping and valves. But one of the most interesting applications is further down the process line, where ion exchange RIP banks are used to remove the uranyl sulfate radicals from the muddy solution. Big four-foot-square Stainless Steel screen baskets containing strong base resins are agitated up and down to do the job. The Stainless screening, resistant to the acid, will not corrode or "blind," and a full flow of solution can penetrate to the resin.

Like other users, you will probably find that the most economical way to use Stainless Steel is right from the beginning. You'll also find that it pays to specify USS Stainless Steel to be sure of service-tested quality.

USS Stainless Steel is available through your USS representative or your local steel service center.

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USS **United States Steel**

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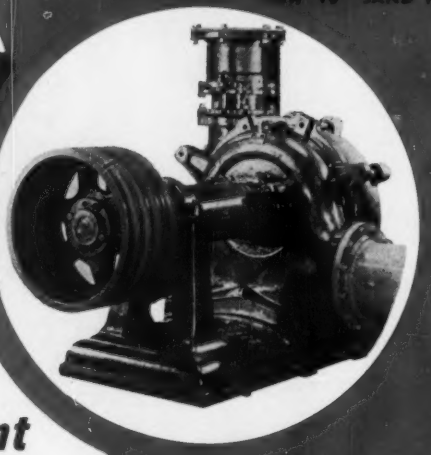

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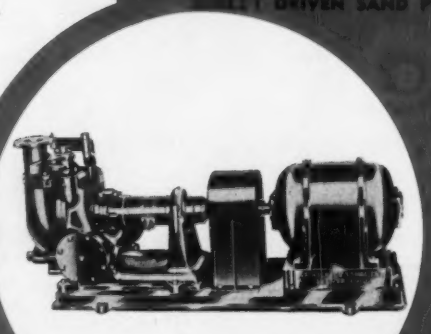

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A Ten-Year Study of Lead Shows Need for Production Control

A Constructive Viewpoint

K. W. GREEN

READERS MAY ASK *why we have published this rather detailed article on lead covering the ten-year period 1947-57. Here are the reasons:*

1. *This article represents a consumer's viewpoint, which all too often is overlooked when mining men get together to discuss their problems. The author has intended this article to be constructive, seeking not low-priced lead, but rather a stable, fair-priced lead market which will benefit both producer and the consumer in the long run.*

2. *Whether you agree with Mr. Green's conclusions or not, we believe that his thorough statistical study of the lead industry will enable you to appraise the causes of difficulties in the lead industry more intelligently, and perhaps to do a better job of forecasting the future of the industry.*

3. *To make this article more useful to you, we have reproduced Mr. Green's worksheets in as large a form as possible. We have perforated the pages on which they appear so that you can tear them out easily to make comparisons between price, production, demand, imports, stocks, shortages and surpluses, all of which have a bearing upon the health of the lead industry.*

THIS IS A STUDY of lead economics in the United States for a period of 10 years beginning in 1948, for the purpose of:

(a) developing a simple form of domestic lead balance sheet which can serve to keep one currently informed of the state of the economy based on statistics which are issued monthly;

(b) observing the pattern of various characteristics of the economy;

(c) observing whether any relationship exists between lead stocks, production, foreign trade, consumption and prices.

A century ago economists expressed the relationship between demand and supply on the one hand and price on the other in this way: "The quantity of goods demanded varies inversely with the price, and the quantity supplied varies directly with the price." In theory this means that lower prices attract greater demand and higher prices stimulate more supplies.

Demand arises from consumer's needs and desires. Supply, on the contrary, is associated with production unless the supply is limited in reserve or to nearby existing stocks of goods. Frequently it is said that we have solved the problems of production but have failed to solve the problems of distribution of the goods produced. In other words, we know more about controlling or stimulating supply than we do about controlling or stimulating demand. In lead we know little about either.

Actual demand in real markets is the result of many factors of which price is only one, and sometimes a relatively unimportant one. Only recently we have witnessed the drop in price of lead. Lead buyers and sellers know only too well that lowering the selling price neither stimulated demand nor increased sales. In fact, psychologically, it did just the reverse. Neither did it lower the supply at a time when such a reaction would have been most welcome in the industry.

The largest user of lead is the storage battery industry (31.5%). Here demand is created not by price but when the consumer wants a new automobile or his present battery has failed to start the engine. The manufacturer builds higher quality into his product which makes it last longer and thereby decreases the demand without regard to price.

On the other hand, raising the price of a material, if carried far enough, might cut the demand by stimulating the use of substitute material. The best sample of this is in the delicate economical balance that presently exists between the use of aluminum and copper for electrical conductors.

As old as man is—that's how long he wanted to "peek into the future." Maybe he wanted to learn how many years he would live, or what wealth he might accumulate, or how he might better compete with his fellow man. He went to astrologers, fortunetellers, and soothsayers for his information and planned his future actions accordingly.

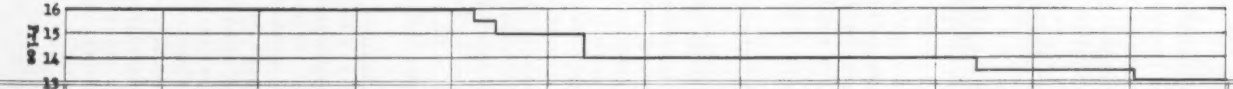
Today the businessman has a more scientific approach. Various reporting agencies continue to gather data pertinent to the many facets of business. Economists assemble a collection of business data and study the past behavior of certain so-called "indicators" from which they attempt to prognosticate whether we are going to "bottom out" or do another "sidewise slip." If enough economists guess the same direction of travel, we believe them. Fortunately, the average human being's memory is relatively short. Unfortunately, with all this help it seems we just cannot regulate our affairs to suit economic conditions and so we get into troubles with unbalanced supply and demand. The Government is appealed to for some kind of help, whether it be tariff protection, import quota, ceiling price, or subsidy.

People who constantly deal with a commodity either as a buyer or a seller, try to keep currently informed on market conditions. Sellers are probably better informed since they have first-hand knowledge of the market through their sales department. Others must rely on news obtained by trade papers and periodicals. All of us can be guided by economic statistics which are available from authentic sources and from which reasonable conclusions become evident provided we have a free market.

Lead statistics are profuse. If one is interested in the mining segment of the industry, the Bureau of Mines (USBM) publishes a monthly report of domestic mine production. Similarly, we can follow production trends in primary producers' refineries, or in secondary lead smelters' plants, or the foreign trade in lead. Nowhere, to the writer's knowledge, has a simple balance sheet been devised that can be followed from month to

Mr. Green is director of purchases for Electric Storage Battery Co., Philadelphia, Pa. This manuscript, completed on Aug. 5, 1958, is published in sign-off form as of that date.

Sheet A. Lead Balance Sheet for 1957



	STOCKS 1st MO.	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	Jan. '58	Final Report Minerals Yearbook
1.	Prim. Smelters & Ref.														
	Ore	77918	80451	81274	82461	81061	81364	82730	97111	84205	80662	76230	65341	79362	79362
	Bullion	40160	40524	42002	43592	40630	35658	37976	36928	38135	35431	35453	37060	36952	36952
	Pig	30237	32418	38479	36390	48053	48286	55358	59348	51080	44467	47459	59757	79743	79743
	Antimonial	10740	9501	9259	8952	8593	9005	8752	7998	8999	9582	10752	10344	11034	11034
	Total	159055	162894	171014	171395	178337	174313	184816	201381	182419	170142	169894	172502	207091	207091
2.	Secondary Smelters														
	Scrap, Gross	61263	56063	57195	50434	46816	47555	42641	45985	44432	46732	50349	45695	48745	52225
	" , Net Pb	40862	37170	38721	34245	32771	34335	29209	31040	30258	32152	34842	30935	32074	34364
3.	Consumers														
	Refined Pig	73673	70135	69044	72508	66560	61327	57063	54982	55844	61758	63715	71651	75773	75773
	Antimonial	40226	38795	39259	37647	36672	35118	32385	27739	31246	33223	33223	35647	37965	37965
	Miscellaneous	10096	9194	9251	9220	9721	10283	10204	9880	9534	8929	8696	9332	8695	8695
	Total	123995	118124	117554	119375	112953	106728	99652	92601	96624	103910	105634	116630	122433	122433
4.	TOTAL REPORTED STOCKS	323912	318188	327289	325015	324061	315376	313677	325022	309301	306204	310370	320067	361598	363888
5.	Unaccounted For	----	18082	18013	28848	49163	71686	87576	89117	105920	119266	132393	152032	150683	185842
6.	TOTAL LEAD STOCKS	323912	336270	345302	353863	373224	387062	401253	414139	415221	425470	442763	472099	512281	549730
	PRODUCTION													Yr. Totals	Yr. Totals
7.	Primary Refineries (ASRS)	50854	48012	52357	56170	51718	48203	47100	48191	50436	52041	48771	50500	604353	604353
	(BOM)	50461	47363	51962	55839	51454	47991	46851	47880	49945	51614	48575	50308	600243	601518
8.	Secondary Smelters														
	Soft Lead	12834	14452	12560	13920	14047	12358	11066	11019	10681	13562	13980	11518	151997	123308
	Ant. Lead	18180	20887	20346	17828	17499	13950	10882	17597	17945	19736	16512	14935	206297	240151
	Other Alloys	4995	2944	5577	5822	5204	6364	4722	5292	5056	5558	5791	4288	61613	122507
	Less Duplication *	4049	3419	4493	3833	2062	3404	1131	2398	1832	1856	2817	2284	33580	44852
	Total	31960	34864	33988	33737	34688	29268	25539	31510	31850	37000	33466	28457	386327	441114
	* Scrap treated at primary refineries.														
9.	Total Domestic Prod.	82421	82227	85950	89376	86142	77259	72390	79390	81795	88614	82041	78765	986570	1,042,632
	FOREIGN TRADE														
10.	Imports														
	Pigs & Bars	31410	22423	20784	25070	22283	28002	25224	23162	23042	31376	32440	39061	324277	324279
	Ant. Lead	414	398	585	248	531	219	139	408	394	340	690	493	4859	4859
	Total	31824	22821	21369	25318	22814	28221	25363	23570	23436	31716	33130	39554	329136	329138
11.	Exports	487	1616	1358	633	1118	489	667	278	282	237	535	137	7837	7837
12.	Net Foreign Trade	31337	21205	20011	24685	21696	27732	24696	23292	23154	31479	32595	39417	321299	321301
13.	TOTAL APPARENT SUPPLY	437670	439702	451263	468124	481062	492053	498339	516821	520170	545563	557399	590281	1,631,781	1,687,845
14.	TOTAL CONSUMPTION	101400	94400	97400	94900	94000	90800	84200	101600	94700	102800	85300	78000	1,119,500	1,138,115
6.	DIFFERENCE	336270	345302	353863	373224	387062	401253	414139	415221	425470	442763	472099	512281	512281	549730
	Net Change #5		+18082	-69	+10835	+20315	+22523	+15890	+1541	+16803	+13346	+13127	+19639	+150683	+185842
KWG	Current Supply (9)+(12)	113758	103432	105961	114261	107838	104991	97086	102682	104949	120093	114636	118182	1,307,869	1,363,933

month and current market conditions analyzed therefrom. The closest approach is the yearly summary of lead by origin of supply contained in the yearbook of the American Bureau of Metal Statistics (ABMS).

What are the essentials of a balance sheet? Stocks, production, foreign trade and consumption. If we account for these according to origin of supplies, we are limited to yearly reports because neither ABMS nor USBM differentiate between lead production from domestic or imported ores in their monthly reports. The better choice seems to be accounting for lead according to class of industry and, wherever possible, to use net lead according to class of industry and, wherever possible, to use net content for each type of material. This method is used in the typical balance sheet prepared for 1957 and included in this study as Sheet A. The divisions of A are numbered and will be described in detail in the following paragraphs.

1. Primary Smelters' and Refiners' Stocks. So often reports include only pig lead and antimonial lead (gross) which can serve only for comparative purposes but do not constitute the entire stocks held by this class of the industry. Sheet A begins with ore stocks as reported by ABMS. Here recognition is given to imported as well as domestic ores and covers only the recoverable lead content. The second item (bullion) is reported by ABMS and includes bullion stocks on hand, in transit, and in process. The third item (pig) is lead in salable form and is reported by ABMS and USBM. The fourth item (antimonial) is also in salable form. The earliest report is made by ABMS, but unfortunately the values reported are gross tons including the antimony content. The writer prefers to wait for the later USBM report because the net lead content is differentiated. Incidentally, the study over the years brought out that antimonial stocks have decreased in antimony content from about 11% to a present average of 7%.

2. Secondary Smelters' Stocks. Source of data—USBM. Each month the USBM report includes the consumption of lead scrap and the lead recovery. The percentage recovery of any month is applied to the gross scrap stock at month-end in order to obtain the net lead content. Prior to January 1956, the USBM report also listed the finished metal stocks on hand at secondary smelters and would be included in (2) of earlier years. Since then, in order to prevent some duplication, finished metal stocks are included with consumers' stocks (3).

3. Consumers' Stocks. Source — USBM. No comments necessary.

4. Total Reported Stocks. Quite obvious—the sum of (1), (2), and (3). For the time being, let us skip over items (5) and (6).

7. Primary Refinery Production. This includes pig lead and antimonial lead made from domestic and foreign ores, also lead in both forms recovered from the treatment of scrap. Two sources of reports are shown. Again, the ABMS figures include gross antimonial lead, but they are entered because ABMS reports are available at least two months before USBM reports, and this gives a quick comparison of monthly production. When USBM reports are received, the production values entered include only the lead content of alloys. This latter figure is then used as a part of the lead balance.

8. Secondary Smelter Production. Source—USBM. An attempt is made to distinguish between hard and soft lead on the basis of the itemized recoveries contained in the USBM report. Those items having little or no antimony are classified "soft lead." Antimonial lead is so classified in the USBM report. In order to prevent duplication of the metal recovered in primary refineries, that amount is subtracted monthly from the secondary production in this typical balance sheet. Attention should be called here to the fact that the monthly reports of secondary lead production miss a certain amount obtained from copper-base scrap which are not reported by several companies until year-end. As a consequence, the final USBM lead report, which is available about eight months after year-end, will show a higher value of secondary production than is obtained by adding the 12 monthly reports. In 1956 this additional amount reported was 57,814 tons, in 1955 it was 67,053 tons, and in 1954, 75,399 tons. It is estimated that the secondary production shown on Sheet A will finally be increased by about 60,000 tons to around 446,000 tons.

10. Imports. Source — Bureau of the Census. Ores, concentrates and base bullion are not accounted for in (10) since they were included in the stock figures in (1). Antimonial metal reported is gross but since the tonnage imported is relatively small, the percentage error is negligible.

11. Exports. Source — Bureau of the Census. Again, ores, etc. are automatically taken care of by change in stocks in (1). Exports of scrap and lead products are included in (11).

13. Total Apparent Supply. This is the sum of total lead stocks, total domestic production at primary and secondary plants, and net foreign trade.

14. Consumption. Source—Bureau of Mines.

6. Total Lead Stocks. Subtract "Consumption" (14) from "Total Apparent Supply" (13) and we obtain the month-end total inventory which is repeated as the opening total inventory in the succeeding month. It will be seen that as succeeding months go by, the total lead stocks exceed the total reported lead stocks by increasing amounts. This difference is reported as "Unaccounted For" (5) and represents any errors in reporting stocks plus any government stockpile purchased or bartered.

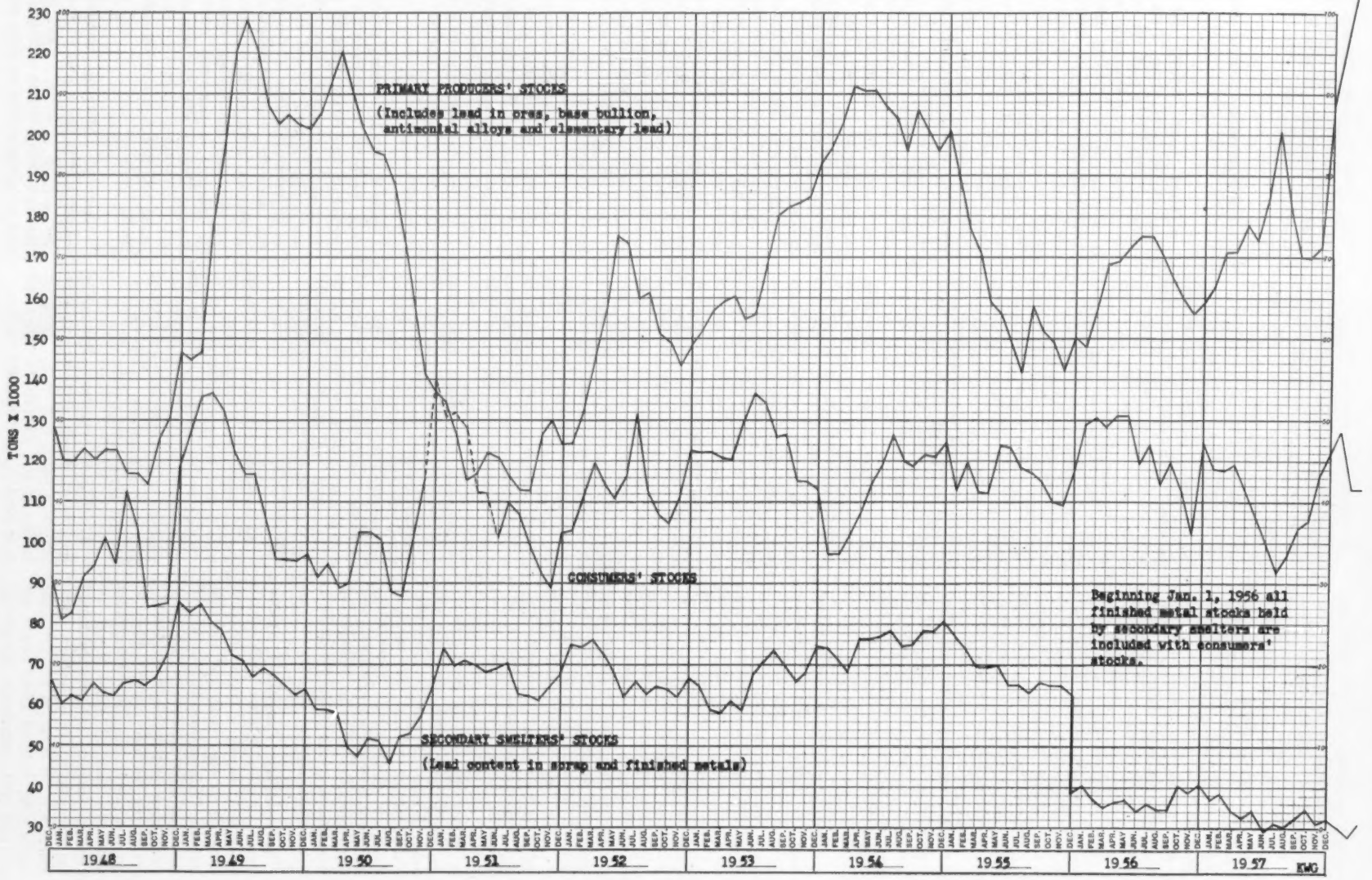
The above-described balance sheet now becomes an important working tool because one can tell at a glance the state of the industry. The entire picture of all stock is readily available. The current supply (9) plus (12) can be visually compared with consumption (14) to obtain the unbalance of supply and demand. Ten balance sheets for the past decade were assembled as our bank of statistical data for this study. You will not be bored with all these figures. Instead, charts have been prepared to cover activities in various segments of the industry and are shown on Sheets B, C, D, E, F, G and H. Their description follows:—

Sheet B. This and succeeding graphs were made to the same time scale (abscissa) so that they might be examined individually or compared with one another. On Sheet B are plotted the stocks reported by primary producers, secondary smelters and consumers.

Sheet C. While primary producers' stocks probably would have the most immediate and direct effect on price, it must be reasoned that over-all stocks (1), (2) and (3) will also have an important influence on the market. For example, rapidly accumulating inventories in the hands of consumers will depress purchases and eventually be reflected in increased producers' stocks. That is why the sum of (1), (2) and (3) were plotted on Sheet C along with prices in London and New York.

Sheet D. Although domestically mined lead is not a part of the suggested form of balance sheet per se, the study would not be complete without including a chart on mine produc-

Sheet B. Lead Stocks of Primary Producers, Secondary Smelters and Consumers



tion for possible matching with the other charts. The deterioration of the lead mining production is quite apparent, averaging 401,900 tons in the first half of the decade and 338,500 tons in the second half, a drop of almost 16%. In contrast, the average annual mine production for a five-year period — 1925-29 was 661,800 tons or 95.5% greater than the last five years.

The graph of secondary smelter production was included on Sheet D, not that it had any direct relationship with mine production, but rather to better utilize the remaining space. The graph is factual, taken from USBM monthly reports. As mentioned earlier, the sum of the monthly value will not equal the final yearly figures published by USBM which are shown below the graph for each year. During the first five years, secondary smelter production averaged 35,900 tons per month. In 1951 when demand far outstripped our supply and imports were the lowest in this decade, the secondary smelter industry produced their maximum tonnage. In the last five years, their production has been fairly uniform at an average of about 37,000 tpm. This is approximately equivalent to moving the graph upward 5,000 tpm to compensate for year-end final figures from USBM.

Sheet E. Lead is important in the form of ores, concentrates, matte, bullion, scrap, and in finished form (directly salable) as pigs, bars and shapes. The latter class minus the exports of pigs and bars enters directly into our suggested balance sheet; hence, it is charted separately in the lower part of Sheet E. On two occasions the import tariff was suspended so these periods are appropriately marked to observe their effect on imports.

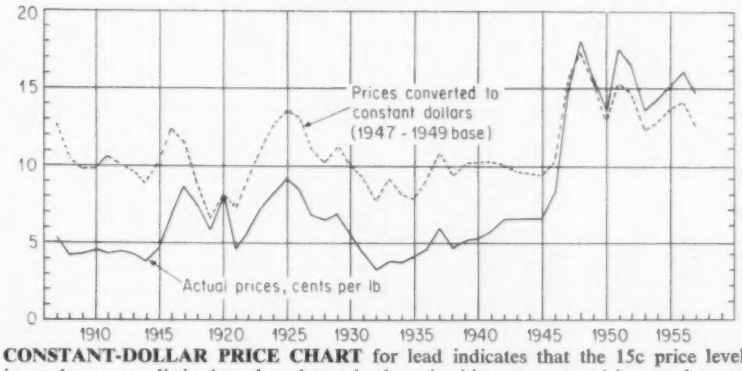
The foreign trade picture would not be complete without showing the imports of lead in unfinished form (ores, bullion, etc.) in the upper chart. It is quite obvious that this class of imports has increased two and one-half times in the last seven years.

Since imports occupy such a prominent position in today's news, one should really go back to earlier years and compare the nature of our imports then with those of today. An interesting comparison of five-year periods appears in the accompanying Table I.

The high value of bullion imports during the first five-year period covered metal from Mexico brought into the U.S. for refining. Since then most of the Mexican bullion is refined in that country.

Table I. Lead Imports in Tons per Year

	1925-1929	1935-1939	1945-1949	1953-1957
Ores and matte	40,100	30,210	67,250	178,800
Base bullion	95,750	13,800	2,255	205
Reclaimed scrap	—	—	12,990	12,335
Total unfinished lead	135,850	44,010	82,495	191,340
Pigs and bars	4,590	3,840	205,170	302,485
Total imports	140,440	47,850	287,665	493,825



CONSTANT-DOLLAR PRICE CHART for lead indicates that the 15c price level is much more realistic than that shown in the price history expressed in actual cents.

Sheet F. Here is an excellent exhibition of the operation of the law of supply and demand. Total new supplies are plotted monthly as the sum of domestic production and net foreign trade. Consumption is plotted in dotted line to distinguish from total supplies. The photographic image of one's eye is perhaps more impressive if you will crayon in blue that area where the total supply line is above the consumption line, and in red where consumption exceeds the supply. London and New York prices are repeated for direct comparison with supply and demand. It will be observed that the highest monthly production of the decade by primary producers occurred in April 1957 when the sting of oversupply really was being felt.

Sheet G. The four largest uses of lead are in storage batteries (32%), tetraethyl lead (16%), cable (10%), red lead and litharge (7%). As for growth, tetraethyl lead has shown the best progress having doubled in usage during the last ten years. Until the last few years, the pattern of usage in storage batteries has almost paralleled the traditional sale of two-thirds the yearly volume during the last half of the year. Lately, battery producers have been trying to even the monthly rate by producing fall stock in the spring months. Unfortunately, there are still fairly wide swings in consumption because of weather quirks, erratic buying habits, and the fact that longer life has been obtained by more efficient use of lead. It would seem that the improvement factor, accounting for almost constant consumption in the face of increasing passenger car registrations, cannot be maintained continuously. Consequently, we should expect an increase in storage battery consumption more closely related to car registrations.

Table II. Price of Lead in Constant Dollars

Period	Actual average price ¢ per lb	Average in constant dollars 1947-49 = 100
1898—1907	4.54	12.37
1908—1917	5.04	10.54
1918—1927	7.11	10.28
1928—1937	4.86	9.20
1938—1947	6.95	10.41
1948—1957	15.40	14.08
Average for 60 years	7.65	11.145

Table II. If you are a consumer of lead, how many times have you heard "remember the olden days when lead was selling at 4½ and 5¢ per pound?" We overlook the fact that the value of the dollar has also changed. Fifty years of average lead prices (N.Y.) are plotted along with the same prices adjusted to constant dollars (1947-49=100). Many people would be surprised to see what the average prices of lead over 10-year periods converted into constant dollars would be. See Table II. To carry it a step further, if the June 1958 average lead price is 11.24¢ per pound, with a wholesale commodity price index of 119.3, the converted price referred to 1947-49 dollar is

Sheet C. Total Reported Lead Stocks in U.S. vs Prices (N.Y. and L.M.E.)

9.42¢ per pound. This is 15.5% lower than the 60-yr average price in constant dollars.

A Yearly Analysis

The charts described before were prepared so that any two or more can be laid vertically adjacent to each other, thereby permitting any comparisons chronologically. Any one graph represents "results" of what has happened. The "cause" may not be apparent except that one might remember what happened historically in any particular year. Therefore it seems desirable to recall some of the events in various years which may have contributed to the result.

World War II began in 1939. In 1942 we really began "tightening our belt" and stopped production of automobiles for the public. Conversion of many factories to war-item production and limitations by governmental regulations resulted in greatly decreased lead consumption by the storage battery industry. The active war ended in 1945 but there was little opportunity to fill the pipeline until 1947. The total automobile battery production rose from 20.6-million in 1946 to over 29-million in 1947.

While this study concerns the past decade, enough happened in 1946 and 1947 to warrant preliminary remarks on conditions in those years.

1946. A ceiling price of 6.5¢ per pound of lead was maintained from 1942 until June 1946. Mine production was encouraged by premium payments for quantities beyond certain bases. Such subsidies had to be increased yearly to develop greater production and amounted to slightly over 3.5¢ per pound in 1945. 1946 was a year of labor strikes, coal shortages, transportation difficulties and other production problems. Removal of the OPA ceiling allowed the market price to reach 12.35¢ in December. For the first 11 months the London price was ahead of New York price so imports fell to 50% of normal. Production at primary refineries was only 75% normal. Result—a deficiency in supply of over 100,000 tons which had to come from stocks.

1947. In contrast to the preceding year, there were no major work stoppages. Demand by the cable and storage battery industries was almost insatiable, the latter using a record 380,000 tons for the year. Total consumption amounted to 1,172,000 tons which was another record. Total supply was only 1,134,600 tons, leaving a deficiency of 37,400 tons to be taken out of stocks. All prior records of production of secondary lead were shattered in 1947. During the year, total stocks held by primary producers and secondary smelters were reduced by one-third. For the greater portion of the year, the London price exceeded N.Y. price by 1¢ per lb, which discouraged foreign imports considerably.

1948. From here on it might be helpful to remove the charts and lay several adjacent to each other vertically. Perhaps B, E and F will provide the more important comparisons for this and succeeding years. The USBM final report has this to say, "Accentuated by the threat of possible lead shortages resulting from unpredictable work stoppages, an accelerated program of defense construction, and Government requirements for the strategic stockpile, consumer demand for lead remained high throughout 1948." A seller's market prevailed within the industry.

Given any threat of possible shortages, the psychological effect on consumers is to try to avoid being hurt themselves, so they try to buy far more than they actually need. This set the stage for a price increase which began in April and continued higher than in London for the remainder of the year. In spite of low imports during the first half, note how consumer stocks rose during the same period.

The peak in demand occurred in October (160,000 tons), coinciding with peak demand of storage battery industry. Some relief was obtained when Congress suspended the import duty in June and imports climbed as shown on E, spurred on by the price differential (Chart F). During September, October, and November, consumers lived largely from inventory plus imports because producers and secondary smelters started their big climb at the end of September. By the end of the year, primary production was back to almost 50,000 tons per month, and this, combined with peak imports of 37,000 tons and secondary smelter production of 36,000 tons, made an excess of supply over demand by almost 24,000 tons. Consumers still had not learned to curb their appetite as will be seen in 1949.

1949. In January the London price took the lead over the New York price, which cut back imports but also helped continue consumer buying beyond his need as shown on consumer stock graph (E). The precipitous drop in storage battery consumption (G) in January was the signal for the price collapse in March. The low point in consumption 63,000 was reached in April. Secondary smelters read the signals first and began inventory reductions one month earlier than consumers.

Large bodies move slowly. Geared to high speed, the monthly production by primary producers averaged 48,500 tons for the first five months. Total supply during the same period (475,000 tons) exceeded the demand by 100,800 tons. Little wonder that primary producers' stocks continued to rise to maximum of 228,000 tons by July 1. During this period, the industry clamored for tariff relief which was not granted until June 30 and not before peak imports of 47,000 tons occurred in June.

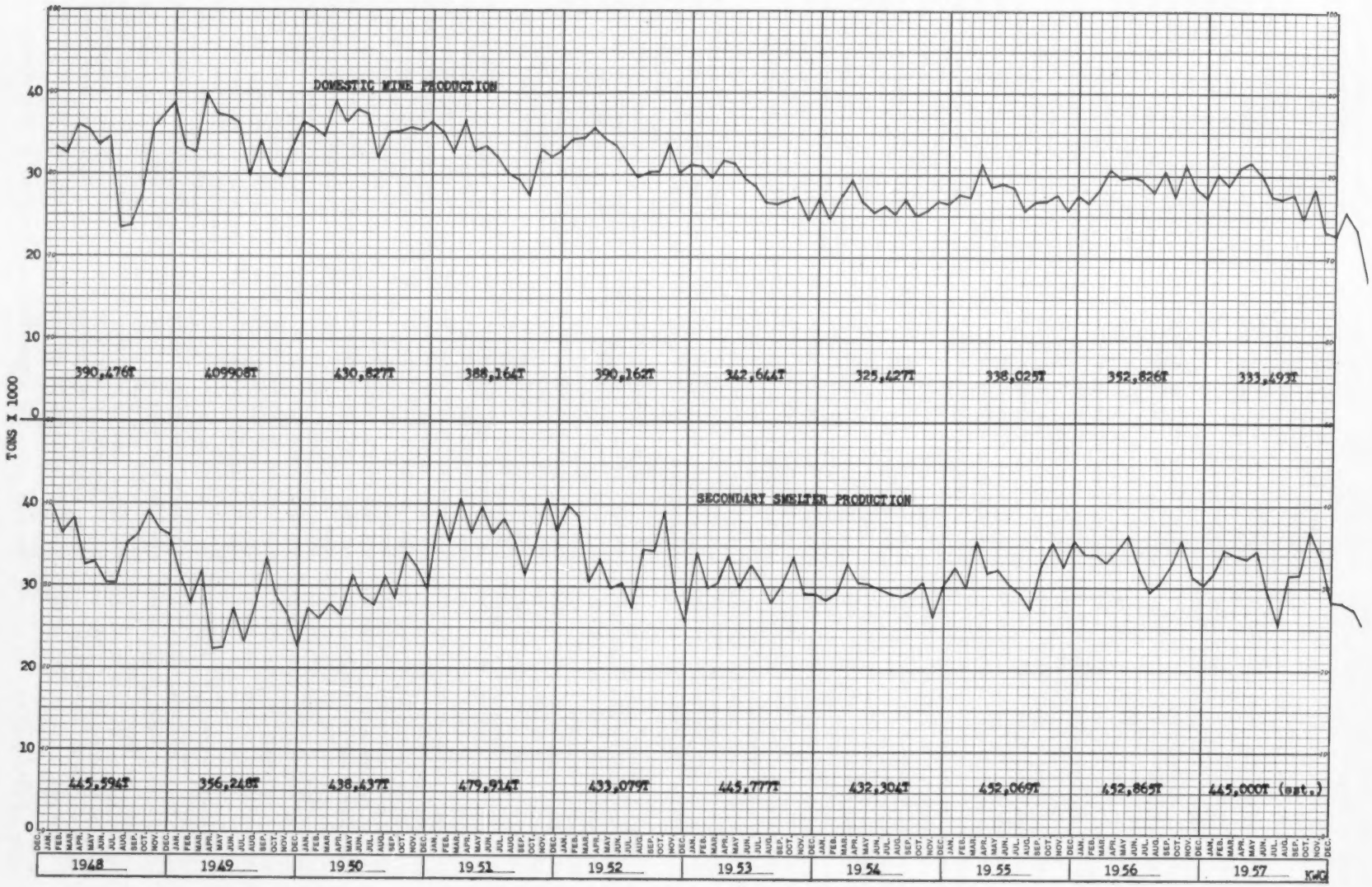
There followed three months during which consumption exceeded current supplies and stocks dropped everywhere. The peak of storage battery consumption occurred early (August) this year and from then on the total consumption decreased steadily to 73,000 tons in December. Again, supply exceeded consumption during the last quarter by 60,000 tons, and since there were no increases in reported stocks, it must be assumed that the excess was absorbed in the Government stockpile.

1950. The first four months were a period of anxiety. Demand was low and both consumers and secondary smelters continued to liquidate inventories based to some extent on rumors that the Government would stop buying for the stockpile in July. Producers' stocks rose to 220,000 tons by April 1, and under such conditions, it was economically natural to drop the price from 12c to 10.5c by March.

War broke out in Korea late in June. Pressure was immediate for acceleration of a National Defense Program which also spurred general industrial activity. Consumers recalled the shortages of World War II and rushed to the market to buy everything including lead, storage batteries and automobiles. During August, September and October, total lead consumption averaged about 125,000 tons per month, which threw the balance to a shortage and increased the price of 17c by October. Consumption for the year amounted to 1,238,000 tons, which was the largest quantity ever recorded before or since 1950.

During 1950 the tariff of 1⅛c remained in effect which was half the 2⅛c set by the Tariff Act of 1930. This reduction resulted from the Reciprocal Trade Agreement made with Mexico in 1943. This agreement was abrogated in June effective at year-

Sheet D. Domestic Mine Production and Secondary Smelter Production



end making the new tariff 2⅛c. In anticipation, imports jumped to 95,000 tons total for November and December. One look at the stock chart (B) tells you how consumers rushed to build inventory.

On Dec. 28, 1950, the National Production Authority issued an anti-hoarding order which included lead, and limited the accumulation of certain materials to quantities needed for reasonable demands of business or home consumption.

1951. Contrary to any normal year, the storage battery industry peak consumption occurred in the first five months of the year. During the same period, the total demand averaged 114,000 tpm compared with a domestic production of only 84,800 per month.

The increase in tariff on Jan. 1 cut imports from an average of 37,300 tons in 1950 to an average of only 13,500 tons during the first five months. This did little to relieve the over-all shortage and with dwindling stocks, the Government did release some tonnage from the national stockpile.

A ceiling price of 17c was established Jan. 26 on domestic lead. Faced with anticipated shortages in supply of domestic lead, consumers turned to foreign lead which drove the London price up in April to our equivalent of 20c (Chart F). It was evident that something had to be done with our supply so the tariff was cut back to 1⅛c on June 6 by reaffirmation of the Mexican Agreement known also as the Torquay Agreement.

Imports did not show any substantial increase because the world market continued to increase with the London price fixed at 22.5c on July 14. Labor shortages in the west during the summer months and a two-week strike at many mines was reflected in a severe dip of production at primary refineries in the second half (F). The domestic industry was compelled to increase costs but the price was frozen, a condition not conducive to stimulated production.

On Oct. 2 the Office of Price Stabilization authorized an increase of 2c a pound effective immediately. Before Oct. 2 domestic consumers could buy lead abroad at any price, but after that date regulations prevented the purchase of foreign lead at prices over the domestic ceiling price plus duty. Of course, this promptly cut off many sales by foreign producers since the world market had moved to 22.5c so the British Ministry of Supply lowered the price to 21.88c to stimulate foreign sales. However, foreign demand soon subsided as exchange difficulties arose and foreign buyers found themselves in overbought positions.

Tribute must be paid to the secondary smelters who rose to the occasion in spite of frozen prices, and produced a record 480,000 tons which has never been surpassed. Primary producers recovered an additional 38,000 tons from secondary sources making a total of 518,000 tons or 44% of the total consumption for this year.

1952. This was a year in which buyers could learn a lesson they should never forget. Economic conditions can change "overnight," figuratively speaking, and that is exactly what happened in the lead industry. Repeating what was said earlier—foreign buyers were overbought and foreign demand had collapsed. After months of shortage in 1951, consumers implored Congress to suspend the duty but such action takes a lot of time because of necessary deliberation. Congress suspended the duty effective Feb. 12 for a period of a year or until the average price for a month should be below 18c per pound. With a collapsing foreign market plus a late assist by Congress, look at Chart E and see how we were deluged with imports.

In a normal pattern, our total lead demand should drop off the first five months of a year and then rise to a peak in September or October. This happened in 1952 but when the supply overtook demand so rapidly, consumers' and primary producers' stocks rose rapidly and the price had to topple. The price broke below 18c by May so the duty was automatically reimposed on June 26.

Some idea of the unbalance in the first six months can be obtained from these statistics:

Domestic production	463,100 tons
Imports	221,800 tons
Total supply	684,900 tons
Consumption	531,000 tons
Excess supply	153,900 tons

It was the practice of the British Ministry of Supply to contract for quarterly needs in advance and to set the price from time to time. Earlier this year when domestic troubles in Australia threatened Britain's supply, she turned to Mexico for her requirements, paying a high price. Not all of these purchases were wise ones because U.K. found herself in oversupply on several occasions, only to be rescued by the U.S. purchase of over 50,000 tons. Local dealers in U.K. felt they could do a far better job of buying and selling so they clamored for withdrawal of Government controls. It was finally agreed that the London Metal Exchange should reopen on Oct. 1, 1952, after having been closed for the past 13 years.

During the summer months, British sales were stagnant. Prior to Oct. 1, the price had been pegged at 16.375c per pound (U.S. currency). On the opening day, the price on L.M.E. broke 3c per pound with sales light. United Kingdom Government stocks had risen to 120,000 long tons which were to be released from time to time in an orderly fashion. This did not help the market and by Oct. 22 the price had dropped to 10.34c per pound. One of the grim aspects of this situation was the depreciation in inventory value which, expressed in U.S. currency, amounted to over $16-million.

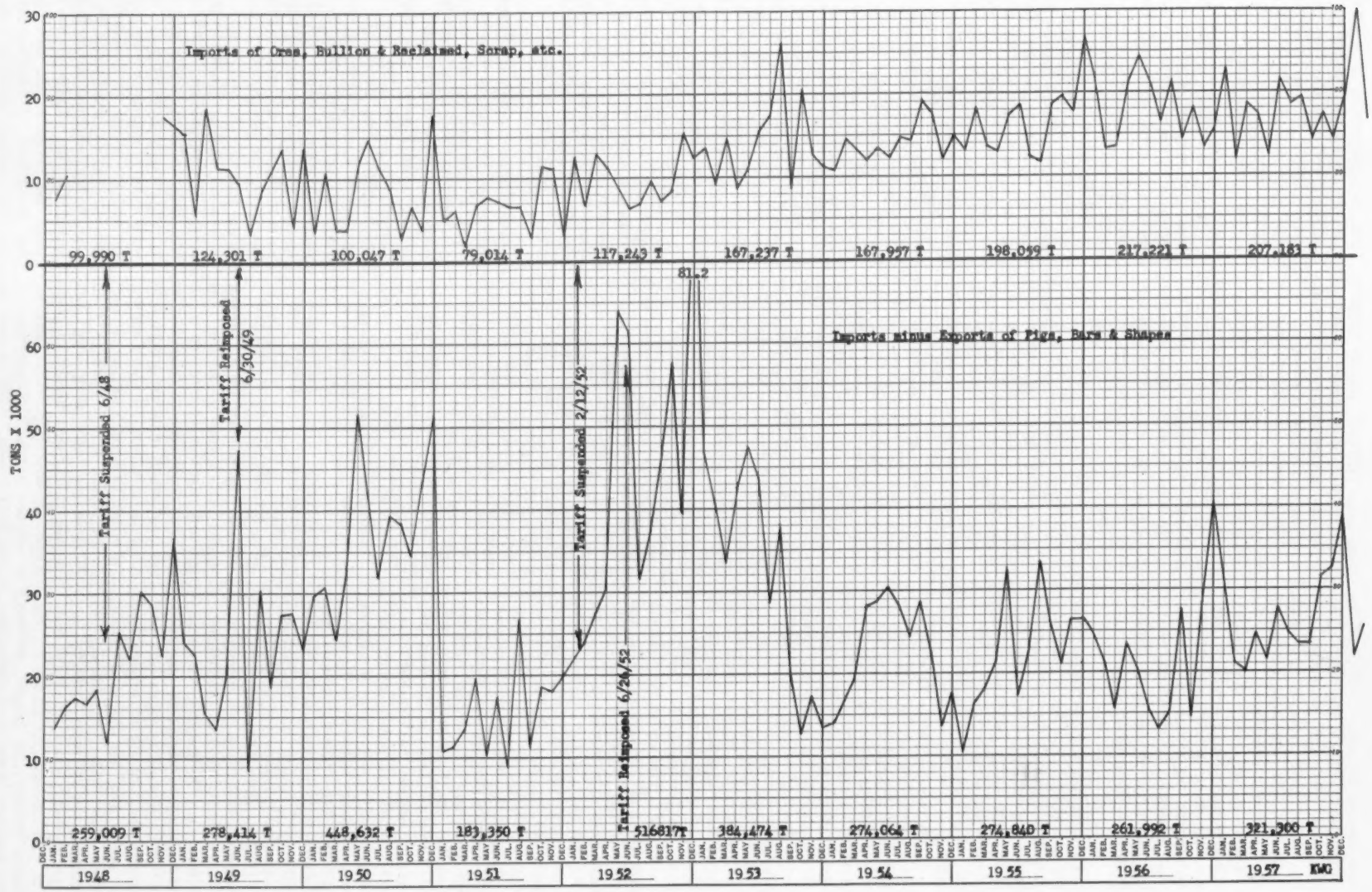
So certain were the experts that the domestic price would hold at 16c, that the U.S. Government made firm contracts at 16c for lead to be delivered the rest of the year. By Oct. 7 the differential with L.M.E. became too great, so the domestic price was dropped to 15c and, on Oct. 22, to 13.5c. There was some slight recovery with the price at 14.75c on year-end.

The chaotic condition of the London market brought about by the liquidation of British Government stocks was relieved by the U.S. Government purchase of some 60,000 tons. This undoubtedly accounts for the all-time high of imports of 81,200 tons in December of 1952.

1953. Imports continued to pour in because of low foreign demand, averaging 40,500 tons per month for the first eight months. During this period total new supplies were 917,000 tons, an excess of 115,000 tons over the consumption of 802,000 tons. Price was wobbly, going through 15 price changes in eight months and striking a low of 12c in April. Then, as if by signal, foreign demand picked up, foreign production dropped, and imports to the U.S. dropped to an average of 16,500 tpm for the remainder of the year.

Over-all supplies for the year still exceeded consumption by 160,000 tons and producers' stocks rose 30% to 193,000 tons. Continued low prices were quite unsatisfactory to producers and the threat of continued excess of supplies, emphasized by two years of high imports, caused them to appeal to the Tariff Commission under the escape clause provision of the Reciprocal Trade Agreements Act. The need for action was stressed

Sheet E. Foreign Trade in Lead



by resolutions of the House Ways and Means Committee and the Senate Finance Committee. The Tariff Commission held hearings in November 1953, but no report or recommendation was made in this year.

1954. On May 21, the Tariff Commission reported to the President that as a result of hearings held the previous November, they were of the opinion that the domestic lead industry was in peril. The Commission recommended increased lead duties to the maximum permitted by law. The State Department advised against such action because it would disturb our foreign trade relations. The President did not accept the recommendation of the Commission, but, instead, outlined in a statement dated Aug. 23 an expanded stockpiling program (200,000 tons) as an integral part of the Nation's defense mobilization base. (Note the time interval to get action).

With the exception of February and the normal drop in July, lead consumption remained remarkably uniform throughout the year (Sheet F). Total current supplies, however, still exceeded consumption (1,095,000 tons) by over 160,000 tons. As a result there was an increase in inventories at both producer and consumer levels. Fortunately, there was a distinct improvement in foreign consumption which limited our imports to only 71% of the amount of 1953.

1955. This was a year of increasing business activity when the FRB index of industrial production rose steadily from 132 to 144. Storage battery lead consumption rose to a peak in October and was the second highest total (380,000 tons) in the 10 years under study. Likewise, total consumption for the year (1,212,600 tons) was the second highest in the decade.

Production was throttled by a six-week strike of mines in Idaho and Montana so that beginning in June and continuing through October, consumption exceeded current supplies by 34,000 tons. With the Government stockpiling program in operation at the same time, total reported stocks were drawn down over 80,000 tons. When primary producers' stocks were down to 150,000 tons by July 1, it was natural to expect the ensuing shortage to exert an upward influence on price. The price rose to 15.5c in September, and then to 16c in December.

The Reciprocal Trade Bill, passed by Congress and signed by the President on June 21, 1955, extended the Reciprocal Trade Agreements Act for another three years and empowered the President to cut tariffs up to 5% a year in each of the three years. Congress authorized expenditure of $600,000 by the Office of Minerals Mobilization for a two-year study to determine and recommend a minerals policy.

1956. Price was steady throughout the year. How could it be otherwise when the Government was "picking up the tab" for the excess 115,000 tons supply over consumption of 1,409,000 tons? Total domestic production amounted to 1,062,700 tons. Of this amount, 610,000 tons came from primary producers who previously had averaged only 530,800 tons annually for the preceding eight years, or an increase of almost 15%. Primary producers' stocks rose to a peak of 175,000 tons at midyear, but over-all stocks at year end differed very little from the beginning of the year.

There was some anxiety for the future because it was believed that the Government would soon reach the goal for the permanent stockpile. Fears were temporarily allayed, however, by the cooperation of the Department of Agriculture in agreeing to barter some of the $8-billion surplus in farm products for lead from foreign sources. Lead acquired this way by the Commodity Credit Corporation totalled 47,569 tons in 1956. It was sold to the General Services Administration and transferred to a second stockpile. If the quantity of bartered lead is subtracted from the lead imports of 1956 (271,200 tons), there remains 223,600 tons of imports which competed with lead produced domestically. Certainly this is quite modest and in itself should be little cause for the consternation that exists in the industry.

1957. The year of political football full of lateral passes but no goals. Enough happened through the year to warrant a somewhat detailed recital of events for the historical record.

Let us begin with the weather. January and February were marked with heavy snow storms and abnormally cold weather which brought a heavy demand for replacement storage batteries. This helped the lead demand picture for both months. Consumption fell off rapidly for the next five months (Sheet F), consumers liquidated inventories and producers' stocks rose to 201,000 tons by Aug. 1.

Foreign consumption was low in the spring months. On May 6, lead on L.M.E. began its nose dive, reaching a 4c differential with the New York price on May 9. This forced the U.S. price down ½c on May 9 to be followed by another ½c drop on May 16. On June 5, London price dropped again to a price equivalent to 11.25c which forced our domestic price down to 14c on June 11. The London price was fairly stable until the beginning of October when further deterioration set in to bring about two more price drops of ½c each.

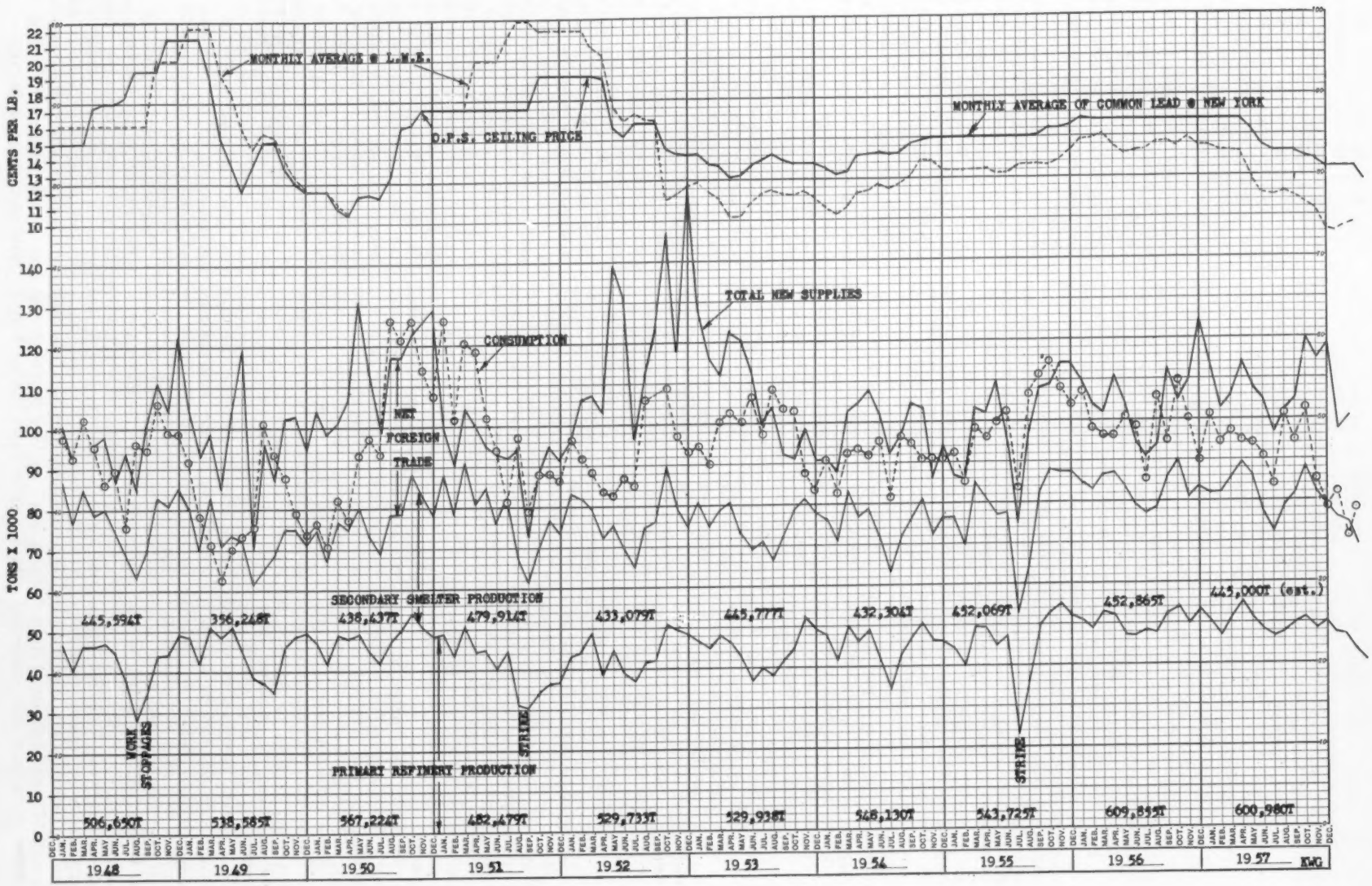
The Lead Industries Association held its annual meeting late in April. Gloom was abundant and the consequences of an anticipated oversupply of at least 175,000 tons seemed grave. The most popular man at the convention was a representative of the Department of Interior who reassured those present that continuation of the barter plan would pick up the load when stockpile purchases reached their goal. Before he returned to Washington, the Department of Agriculture thought otherwise and imposed restrictive conditions on all future bartering that stunted the effectiveness of the plan. Even so, a total of 82,402 tons of lead were bartered this year.

If the bartered imports are subtracted from total imports, the difference of 246,700 tons again does not seem overburdensome for a normal lead economy. What then is the cause for the troublesome unbalance of supply and demand? Could it be the imports of ore, bullion, scrap, etc., which have more than doubled in 10 years (Sheet E)? If so, who are making these imports?

There is little doubt of the predicament of the domestic lead industry. Appeals were made to Congress for help and 10 different bills were proposed in the House and the Senate. Where was the Administration's long-awaited minerals program? On June 19, the Secretary of the Interior sent the draft of a proposed bill to the President of the Senate, amending the Internal Revenue Code of 1954 and asking for changes in import taxes of lead and zinc. A sliding scale excise tax would be substituted for the present tariff, which has been part of a "General Agreement on Tariffs and Trade" (GATT) existing between various signatory countries. A "peril point" of 17c was identified. At or above this point, the excise tax would be suspended; 16c—17c, the tax would be 1c; 15c—16c, the tax would be 2c; and below 15c the tax would be 3c.

Domestic producers criticized the proposed bill as not providing sufficient protection. They urged strengthening of the bill by taxing 3c on imports when the price broke below 17c, and at lower prices two steps of 1c each were added making ultimate provision for a 5c tax.

Sheet F. New Lead Supplies, Consumption and Prices



The Senate Finance Committee held public hearings on July 22, the House Ways and Means Committee on Aug. 1. Arguments for both sides of the case were profuse. The Department of State had a foreign policy to consider. Countries such as Mexico, Canada, Australia and Peru were involved heavily because lead and zinc imports to the U.S. are an important segment of their economy. High excise taxes would affect the prices they receive and possibly place the volume of business in jeopardy. They could provide retaliation that might ultimately affect our foreign trade relations.

The time for adjournment of congress was fast approaching. The Senate Finance Committee voted 11-2, on Aug. 16, in favor of a flat 3c tariff. The two dissenters threatened to block further action on the floor of the Senate. The chairman refused to "report out" on the bill until he received the approval of the State and Interior Departments. This was not obtained. Then, another plan was attempted, that of tacking the proposed bill as a rider on a previously passed House bill dealing with mica products. The House Ways and Means Committee was incensed at this action and served notice that they would vigorously oppose the bill when it was returned to the House for reconciliation.

The Chairman of the House Ways and Means Committee then released a letter to the President, declaring that the President had all the authority needed under existing law to give whatever the lead and zinc industries may need. He was referring to the escape clause provision in the Reciprocal Trade Agreements Act. The President replied that he agreed, under the circumstances, to refer the matter to the Tariff Commission for expeditious study and recommendation. The chance for any passage of a relief bill by this Congress died then and there.

The Tariff Commission held public hearings beginning Nov. 19, at which time there began the same testimony, pro and con, that had previously been taken in 1953 and which resulted in a recommendation that was never followed. The industry had hoped for some recommendation before year-end but it was not forthcoming.

1958. While this study was intended to cover only 10 years, one would be delinquent in leaving this story in such a suspended state of inaction. In purchasing foreign lead, duty is normally for the account of the buyer so that with the risk of having to pay possibly a higher duty on short notice, few buyers wanted to trade in foreign lead. For the first three months, the London price was steady at slightly over 9c per pound while the New York price was 13c. This differential was enough to attract brokers to arrange for barter transactions that could be completed in a short time.

People grew more restless awaiting some word from the Tariff Commission. The domestic economy was going downward as shown by the 12.5% drop in FRB industrial production index from August 1947 (145) to April 1958 (126). Lead consumption for the first four months averaged only 77,800 tons per month. Primary producers' stocks rose over 60,000 tons in the first six months so that in order to keep down the cost of inventory, which was accumulating rapidly, there was no choice other than dropping the price.

On April 24, 1958, five months after hearings began, the Tariff Commission recommended that the tariff on unmanufactured lead and zinc be increased. The Commission split, however, in the degree of change. Three members favored a quota on imports plus the maximum increase in duty permitted by law, which would raise the duty to 2.55c per pound. The remaining three members were opposed to a quota but favored a return to the duty existing in 1930 which was 2¼c per pound.

Four days later, April 28, the Secretary of the Interior presented to a Senate Interior Committee a subsidy plan which would set price levels for copper, lead, zinc, fluorspar and tungsten and would authorize the department to make up the difference between them and market prices within certain maximum tonnages prescribed for each commodity. For lead, the stabilization price was 14.75c for a maximum of 350,000 tons. No mention was made of another plan for stockpiling and there was the implication that the Administration would prefer this course of action to the one favored by the Tariff Commission. No floor in price support was specified so that critics were quick to point out the possible abuses of dumping at low prices at government expense.

A proposed draft bill was sent to Congress May 23 by Secretary of the Interior Seaton for payment of subsidies as outlined above but with a maximum subsidy of 3⅜c for lead. The tonnages were to be allocated among the various mining companies and according to quarters of the year. The plan was opposed by an industry group who pointed out the difficulties of trying to administer it as well as the annual problem of getting a House Appropriations Committee to appropriate the necessary money.

Amendments and new bills followed. One proposed that 70% of the annual collection of lead import duties be used to partially pay for the Seaton plan. Another plan proposed an increase in the stabilization price to 15.75c and pay 17c for the first 500 tons mined in any quarter by any domestic mining company. Another plan was to reinstate a stockpiling program involving 100,000 tons of lead to be acquired at not less than 13c per pound.

On June 19, the President wrote to both Houses of Congress advising them that he was deferring any action on the recommendations made by the Tariff Commission in lieu of present consideration of the Seaton subsidy plan. On June 24, the National Chamber of Commerce advised Congress that federal price supports would lead to Governmental control and perhaps eventual nationalization of the minerals industries. The Chamber recommended use of the escape clause of the GATT Agreement.

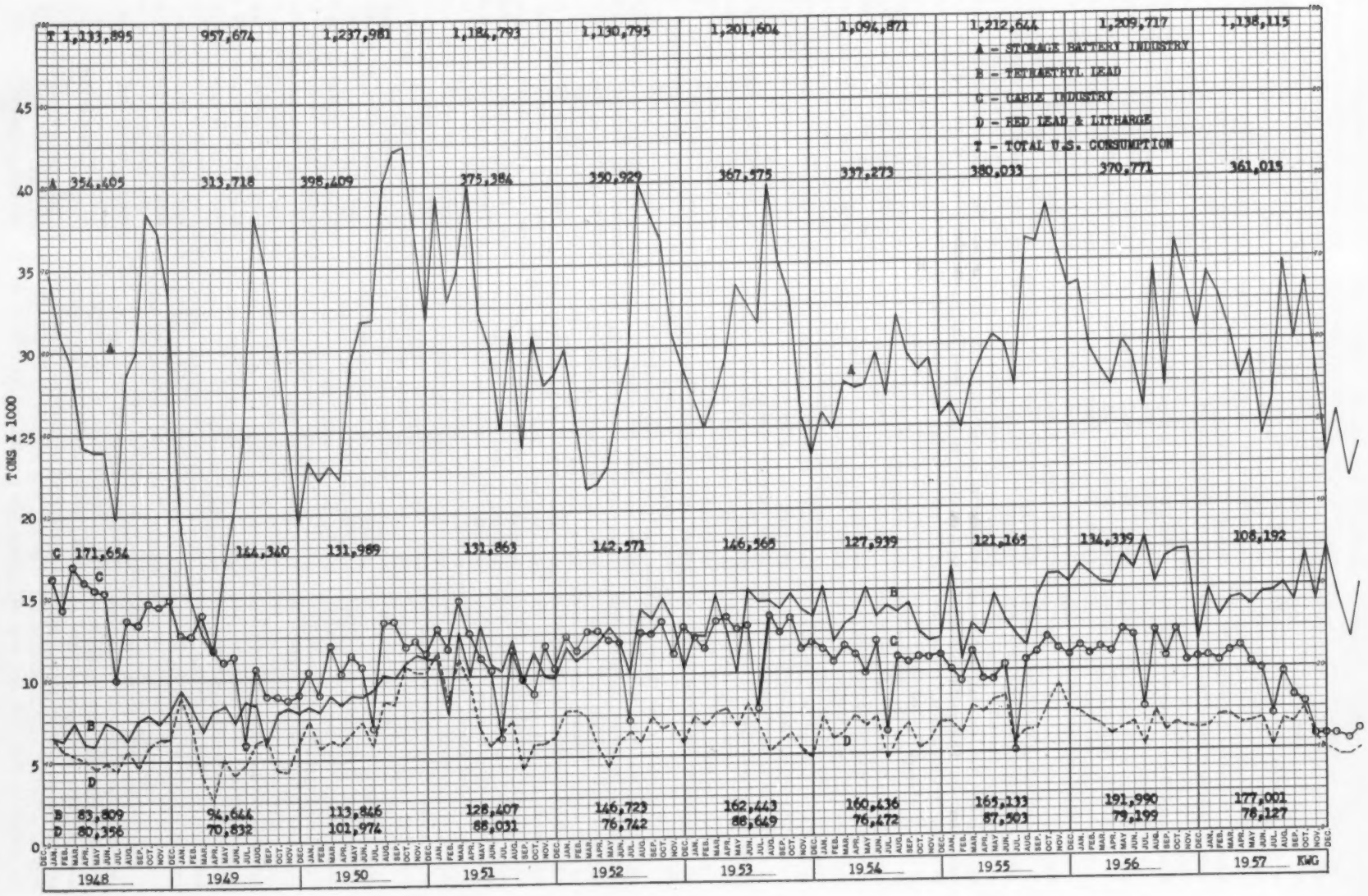
On July 11, the Senate passed the Seaton Bill (70-12) with provision for a stabilization price of 15½c, a maximum subsidy of 3.9c for lead, a bonus to help small companies on the first 2,000 tons produced per year, and authorization of the Interior Department to borrow up to $350-million to finance the complete program (including other minerals) over five years. On July 17 the bill passed to the House Interior Mining subcommittee who objected to the bypass of the Appropriations Committee. They increased the subsidy to 4c and returned the "financing" to the Appropriations Committee procedure. On July 28, the House Interior Committee cleared the bill (S-4036), reduced the subsidy to 3.9c, and put a $650-million ceiling on the cost of the over-all program.

The bill then passed to the Rules Committee and, as of Aug. 5, the matter was not even scheduled for consideration. From the Rules Committee the bill passes to the House for a vote and assuming passage in some different form, it must then go to the Conference Committee between the two Houses. One can see that the obstacle course practically eliminates any help from Congress which is straining to adjourn by Aug. 15.

Conclusions

1. The consumption of lead in the United States has not kept pace with the increase in industrial activity but

Sheet G. Lead Consumption of Largest Consumers



rather displays evidence of stagnation. Here is the comparison over the last decade:

Years	F.R.B. Index Industrial Production*	Index of Lead Consumption*
1948	104	104
1949	97	88
1950	112	114
1951	120	109
1952	124	104
1953	134	110
1954	125	101
1955	139	111
1956	143	111
1957	143	105

*1947–1949 = 100.

2. The U.S. is not self-sufficient in lead. Domestic production expressed as a percentage of demand has varied over the years as follows:

1948 — 83.98%	1953 — 81.20%
1949 — 93.44%	1954 — 89.55%
1950 — 81.23%	1955 — 82.11%
1951 — 81.23%	1956 — 87.85%
1952 — 85.14%	1957 — 91.61%

10 Year Average — 85.7%

Table III. Suggested Quota Plan

	1953-57 Average tons	1953-57 Average percent	Suggested Quota tons	Suggested Quota percent
Domestic production				
Primary smelters & refiners				
Pb from domestic ores	331,645	25.21		
foreign ores	170,275	12.94		
scrap	4,140	.31		
Pb-Sb from domestic ores	8,015	.61		
foreign ores	8,385	.64		
scrap	44,175	3.36		
Total primary producers	566,635	43.07	483,340	43.94
Secondary smelters & refiners	444,825	33.81	379,500	34.50
Total domestic production	1,011,460	76.89	862,840	78.44
Foreign trade				
Imports as metal				
(a) By barter transactions*	26,600	1.98		
(b) by private individuals and companies	284,800	21.65	242,990	22.09
Total imports	310,800	23.63	242,990	22.09
Exports in all forms	6,770	.51	5,830	.53
Total net foreign trade	304,030	23.11	237,160	21.56
Total supply	1,315,490	100.00	1,100,000	100.00
Total consumption	1,171,390	89.00	1,100,000	100.00
Excess supply	144,100	11.0	0	0

*47,500 tons bartered in 1956 plus 82,400 tons bartered in 1947.

3. It is axiomatic that given any reasonable market or demand, the flow of lead is to the location of the highest price. Artificial restraint of price by governmental edict, while intended to prevent inflation, can stifle domestic production and seriously upset a normal supply-demand position. Best example—1951.

4. There is a definite relationship between stocks, other than those held by the Government, and price. See Sheets B and C.

5. It is natural that the consumer does not wish to pay any more than he has to pay. A low price level discourages enterprise, and if carried too far, it can "kill" a part of the industry. On the other hand, it seems as though an attempt was made to push the pendulum just as far in the opposite direction when peril points of 17c lead were identified. Except for small marginal producers, fair profits were made with lead at 15c per pound. Perhaps compromise of ideas is in order.

6. Stockpiling by the Government is not the answer to the problem. This fact was admitted by the Secretary of the Interior when the Seaton plan was introduced. Stockpiling is only a palliative and only delays the day of reckoning. How long could private industry or company survive with an inventory ratio of almost 20:1? If the next major war will be an atomic war, and it will be decisive in a matter of months, is it good business or good strategy to sit with such a large inventory? Is it reasonable to conceive that some future administration practicing a program of austerity might decide to liquidate well over $400-million worth of lead stockpile? How could the domestic industry ever cope with such competition? This same stockpile is costing the taxpayer almost $11-million per year to carry the finance charges.

7. Subsidy is not the answer to the problem. Production quotas will stimulate production at least up to the maximum applicable quota which, in the case of the Seaton plan, is higher than the present production rate. At best it is only an artificial stimulant to only one segment of the industry (domestic mining) that eventually leads to governmental control and does not get at the basic cause of the trouble—over-supply. It is costly to administer and requires constant police action to prevent abuses.

8. It would not seem prudent to point out the critical aspects as mentioned in the foregoing conclusions without suggesting some corrective plan for the consideration of interested parties. Stated briefly and simply, it is this: tailor our production and imports to fit consumption. Now, when individuals or companies do this it is unlawful; when the Government does it, it is legal. We do not wish Governmental control but rather the official sanction by the Government for an industry group to attempt to solve the problem in a business-like manner. The industry group referred to above should represent primary and secondary producers, importers and consumers.

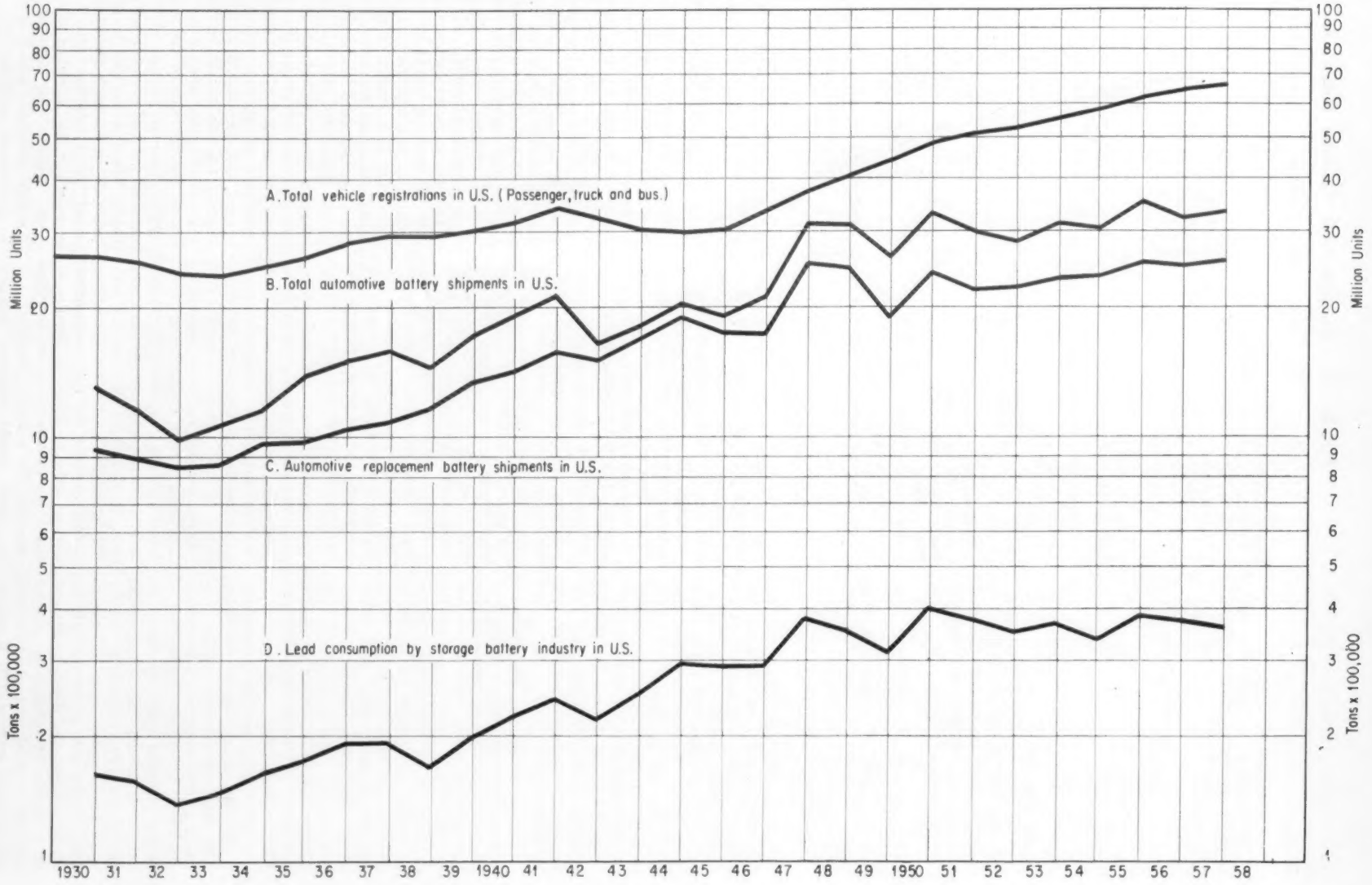
A Suggested Quota Plan

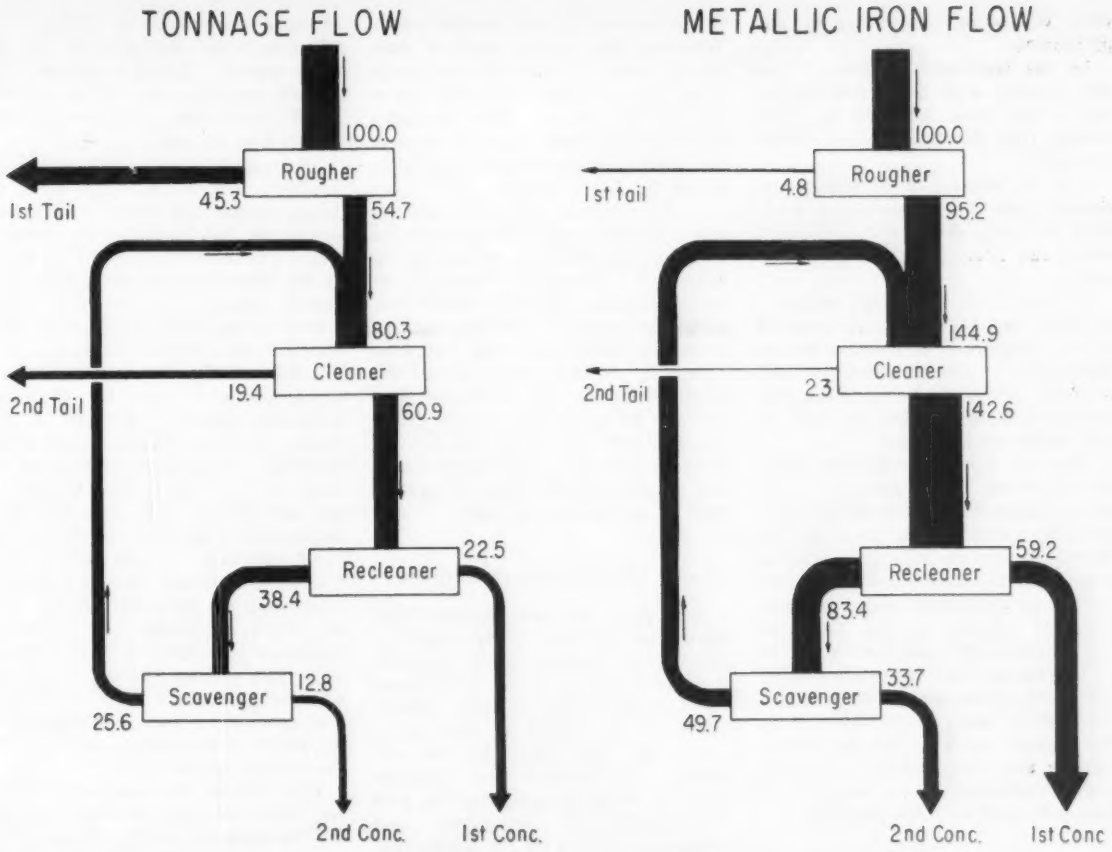
Subject to sanction either by law or express agreement of the proper government division, a committee would be formed by the producers, including the mining industry, the regularly established importers of lead, and at least four of the larger class of consumers. It would be their purpose to set quotas of production and import commensurate with anticipated demand, subject to adjustment at specified intervals.

In looking at the statistics of the past 10 years, it would perhaps be difficult to pick any one year as representative of a "norm" without favoring one group or another. The first five years contained two violent price cycles (Sheet F) plus an imposed domestic price restraint, all of which had abnormal effects on the flow of lead. The second five years show some semblance of greater stability and suggest that an average of all components for this period become the basis for a quota wherein we would try to balance supply and demand.

The five-year average of components of the lead economy are shown below. There is included a suggested quota of an assumed anticipated demand of 1.1-million tons. Barter transactions are excluded from imports because they do not enter domestic commerce and flow directly to government stockpile.

Sheet H. Vehicle Registrations, Battery Shipments, and Lead Consumption by the Storage Battery Industry





RESULTS such as these are typical of High Tension separation of iron ore. Feed was martite assaying 24.87% Fe. Combined concentrate contained 65.34% Fe, while the tailings ran 2.73% Fe. Numbers at key points on flowsheet indicate % or lb.

How High Tension Electrostatic Separation Recovers Iron Ore

R. E. BARTHELEMY

HIGH TENSION electrostatic separation is a perfectly suitable technique for the beneficiation of the iron ores, and we are personally convinced that it will be the universally adopted technique of the future for the treatment of complex low grade magnetic and nonmagnetic iron ores.

It offers to the metallurgist a long sought-for dry method not affected by severe winter conditions which paralyze all wet methods. It is, at the same time, a method independent of the magnetic conditions of the iron minerals, which requires only relatively low drying temperatures but no preliminary alternative high temperature treatment like magnetic roasting.

Outside of these two extremely important advantages (no water required, no modifying roasting necessary), high tension, as embodied in the Carpco separator, is a high capacity operation (requirements vary between 5 and 8 ft of rotor length per long ton per hour of ore treated). Like all the other techniques, it is also sensitive to slime coating, but with many ores the slime interference is very small or altogether unnoticeable.

As for operating costs, they are low and the power consumption is practically negligible. These costs on the basis of a minimum 5,000-tpd plant with requirement of 5.5 ft of rotor length per long ton per hour, are the following per long ton treated:

Maintenance (labor and material)	1.534c
Power	0.234c
Labor (operating)	2.286c
Total	4.054c

Whether applied alone, or in combination with other techniques, High Tension separation has demonstrated that it is a versatile method of beneficiating a large class of non-limonitic iron ores.

In the treatment of the Canadian-Labrador iron ores it has proved that it can produce the highest grade of concentrate possible with an excellent recovery on a full year-around operating basis.

In one single operation, requiring no alternative heat treatment, it can successfully beneficiate complex iron

Mr. Barthelemy is director of research, Carpco Research & Engineering, Jacksonville, Fla. This condensation of his paper, "Iron Ore Beneficiation and High Tension Separation," from the American Mining Congress, San Francisco, Calif., 1958, is by permission of the author.

ores containing magnetite in any proportion.

In the treatment of fines it can still produce high grade concentrates and is no more hindered by slime coating than flotation itself in similar conditions.

For the separation of biotite and apatite from iron minerals, it is probably the only satisfactory technique which can effect it in a single operation.

In association with other methods, it could find numerous applications such as upgrading of concentrates or elimination of specific impurities, and it could very well be an ideal pretreatment technique for the new direct reduction processes.

Since the Korean conflict the influx of high grade foreign ores, which increased hyperbolically from less than 10-million tons in 1952 to more than 30-million tons in 1956, has sparked a technical revolution among the iron producing companies and a decisive trend is actually in full swing to switch from lumpy direct-smelting ores to beneficiate ores. Even a small increase in grade of the concentrates can give a relatively big decrease in the amount of SiO_2 fed to a blast furnace and, consequently, a considerable reduction in the amount of limestone necessary for slagging.

More Beneficiation

Iron ore beneficiation future is no doubt extremely bright as research for new sources of iron ores indicates that the largest reserves of the future are in lower grade, non-direct-smelting ores which will need beneficiation. Already in 1957, more than 40% of the Lake Superior ores had received pre-smelting treatment requiring either beneficiation or agglomeration (sintering or pelletizing), and in Minnesota alone, 78 beneficiation plants were operating.

In the last pre-recession period, it can be said that the increased U.S. iron ore requirements were satisfied by imports, while the U.S. ore production remained practically unchanged at 95- to 100-million tons.

Within the next 20 years, it is estimated that the U.S. requirement of iron ore will increase by 75-million tons from the present 125-million to a 200-million forecast. The U.S. yearly production seems to be well stabilized around 100-million. Consequently, by 1975 or 1980, about 100-million tons of ore will have to be imported.

Outside of Venezuela, which is a vulnerable source of supply in case of war, there remains only the vast Quebec-Labrador iron field and possibly still unknown deposits farther north. Whatever their origin, most of these foreign ores will certainly be beneficiated ores, as they will need to be as rich as possible to offset increased transportation costs and to improve the smelting efficiency and the capacity of the blast furnace.

As the foreseeable situation appears today, Canadian ores will provide the bulk of our imports, according to Verne D. Johnston's forecasts in *E&MJ*. Canada should possibly contribute as much as 75-million tons to cover our deficiency. The Labrador Trough is without doubt one of the largest iron ore provinces and may prove to be one of the world's greatest. By 1957 the Iron Ore Co. of Canada, operating near Knob Lake, had produced more than 35-million tons of direct-smelting ore.

Lots of Specular Hematite

Since then, developments have been rapid and extensive prospecting has taken place farther north (Ungava Bay) and farther south (Mt. Reed-Mt. Wright-Lake Wabush area), where a large field of low grade (30% Fe) hard rock iron ore, essentially mineralized in specular hematite, is challenging the old iron ore beneficiation techniques and opening a new field of application for the High Tension method of beneficiation.

Beneficiation of iron ore generally presents some complex problems due to the variety of minerals which are associated with the desirable iron minerals. Biotite is one of the common associations and in the Scandinavian deposits, hypersthene is often present in important proportions. These two minerals have a specific gravity greater than 3 and are magnetic. In gravity concentration and magnetic separation their presence may raise a serious problem of separation, while their separation by high tension is extremely easy as they are both non-conductors and consequently are automatically rejected in the High Tension tailings.

Since the High Tension separation technique is based on the difference in surface conductivity characteristics of the minerals involved, it results that the High Tension machine can only separate minerals that have good superficial conductivity from ores of poor or low conductivity. In the family of iron minerals, High Tension separation will then successfully apply to hematite, magnetite and martite, which have a high dielectric constant (over 80); while no satisfactory separation can be expected for iron minerals containing some molecular water of hydration such as geothite and limonite, the dielectric constant of which is in the vicinity of 10. For the same reason, should pyrolusite (dielectric constant over 80) be present, it will not be separated from the conductor iron minerals.

In its application to iron ore beneficiation, the classical flowsheet of High Tension separation, which was developed for beach sand concentrates treatment and proved its value in the titanium fields of Florida, was slightly modified as it was found that a final tailing could be efficiently produced in the rougher stage.

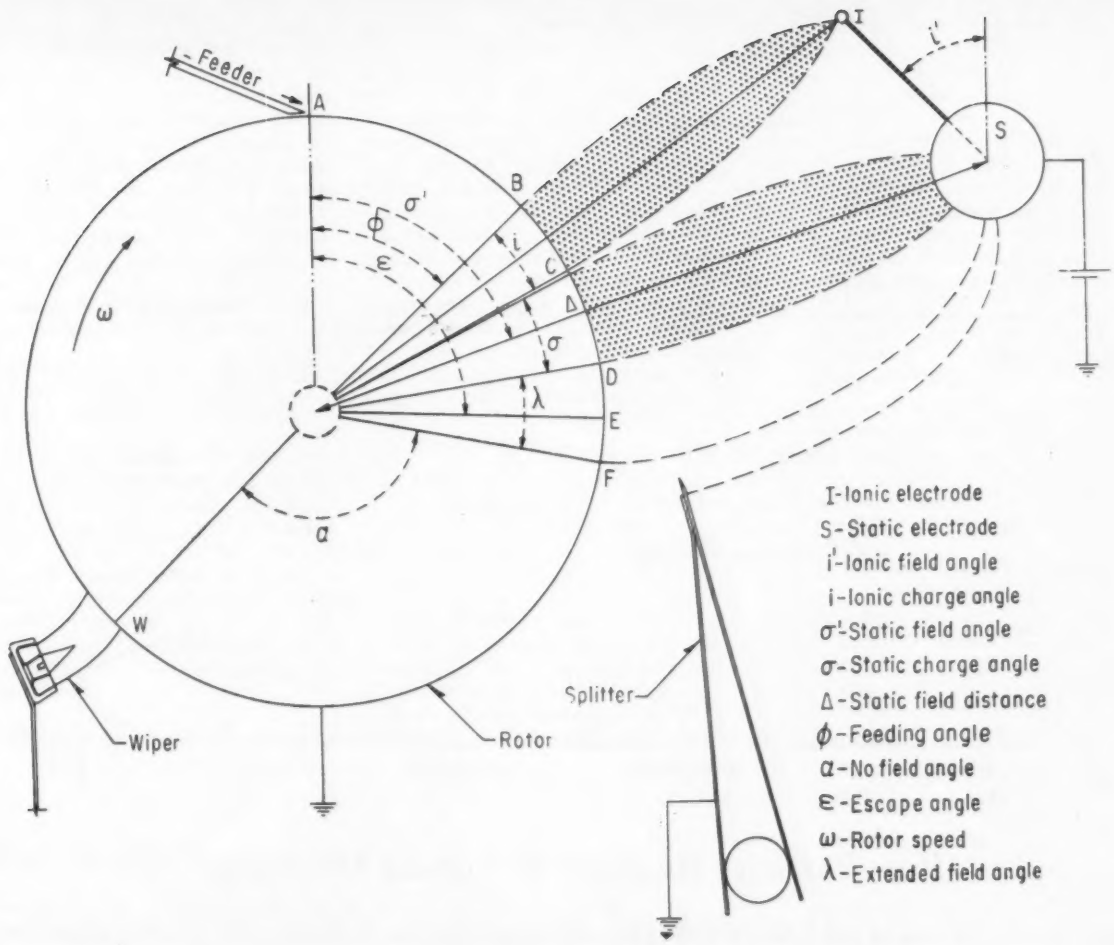
Consequently, for iron ore treatment, we have come to adopt the foregoing general flowsheet. It remains, however, subject to slight modifications (suppression or addition of some of the intermediate stages) to suit any type of ore. This flowsheet consists of a primary rougher treatment rejecting a final tailing; the rougher concentrate ores to a cleaner which yields a rejectable cleaner tailing, while the cleaner concentrate is recleaned to obtain a final concentrate. The recleaner tailing is sent to a scavenger which gives a second final concentrate and a scavenger tailing which is returned to the head of the cleaner circuit.

With certain ores easy to beneficiate, recleaner and scavenger stages may be omitted and the cleaner concentrate may be final. On the other extreme, with difficult ores and with finely ground ores (all minus 200 mesh), a second cleaner stage to reject a third tailing may have to be added to the flowsheet.

The Quebec-Labrador type of iron ores (specular hematite) has proven to be easily amenable to beneficiation by High Tension and we have found that the quality of the separation improves from East to West, with the variation in structure of the ore. Ores coming from the northeastern section near Lake Wabush seen to contain a higher production of manganese and their limonitization is sensible. Limonitic slime interference is acute and such ores require desliming before high tension treatment. Pilot plant testing on a minus 28-mesh deslimed ore of that type gave the following results:

A grade of concentrates, if Mn is taken into account, is over 65% (Fe+Mn) with a rejection of 90.75% of the silica, and a retention of only 2.67% of the total silica in the high tension concentrates.

At Lake Jeannine, the mineralization, as far as separability is concerned, is much cleaner, with no manganese to adversely affect the quality of



How the Position of Separator Elements Affects Results

FIG. 1. The essential features of the Carpco machine are a revolving, electrically grounded 6-in. dia rotor, the surface of which is conductive, and a charged double electrode made of a small cylinder (S) (1 in. dia) acting as static electrode, and a thin tungsten wire (1) orientable about it, constituting the ionic electrode.

On the machine, the relative position of these different elements can be set at will, as the following variables are entirely adjustable within reasonable limits:

- Δ and σ' Relative position of electrodes and rotor;
- i' Relative orientation of ionic electrode;
- ω Rotor speed

In practice, the maximum potential (about 40,000 volts dc) is maintained between rotor and electrode and the static field distance (Δ) is set to obtain only occasional sparking between the ionic electrode and the rotor, but to maintain an audible corona discharge resulting from the constant flow of electrons, in the ionic field.

To simplify the explanation, we shall assume that the feed of ore is delivered horizontally at the high point (A) of the rotor. In their clockwise travel, the particles of ore, submitted to the force of gravity (mg), a centrifugal momentum (mw^2r) and electric forces (F_e), move through the zones shown in Fig. 2.

---

the hematite and no limonitic alteration to provide a source of slime coating.

High Tension separation becomes in this case spectacularly impressive and the results are close to absolute perfection. On such an ore (38.2% Fe) crushed to minus 20 mesh and without any desliming whatsoever, we realized the following separation:

+200 mesh concentrate	69.3% Fe
−200 mesh concentrate	68.6% Fe
Total recovery	97.5%

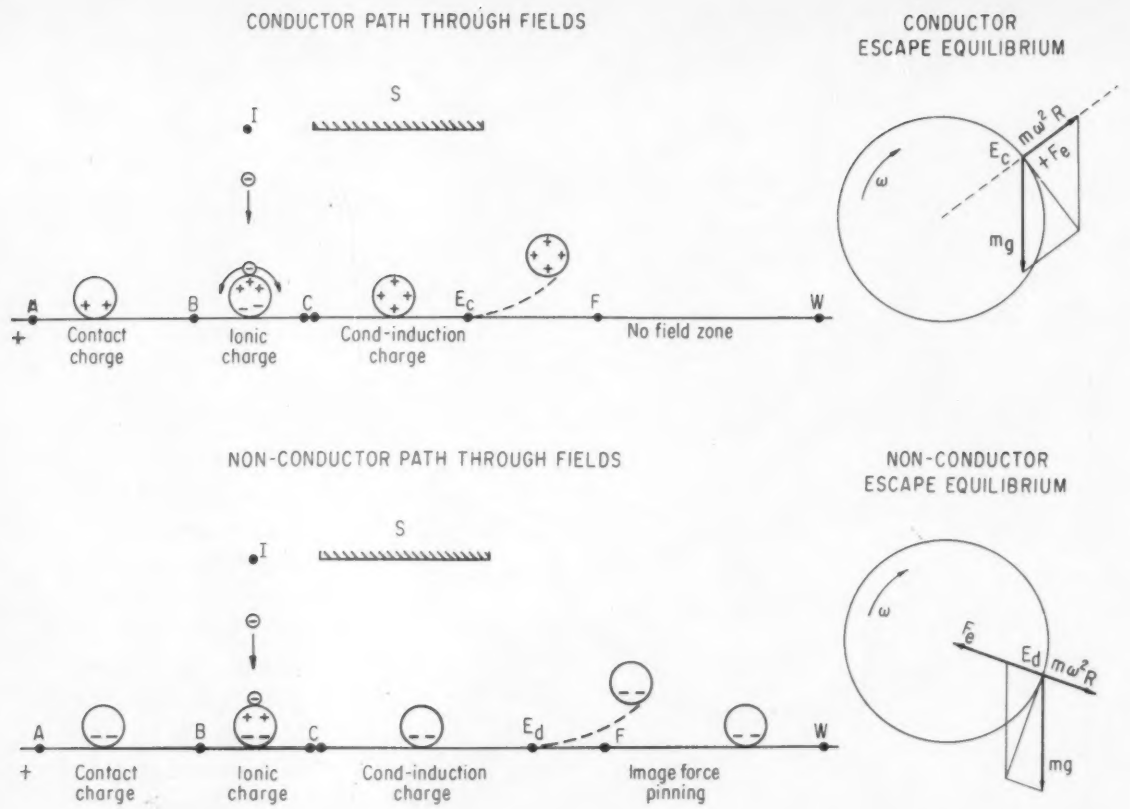
Another type of iron ore highly amenable to beneficiation by High Tension is martite. This ore, irrespective of the amount of magnetite it may contain, can be treated with great success and the following results are typical of one of our treatments of a low grade plus 200-mesh martite ore (25.6% Fe) from New York State:

First conc.	66.4% Fe
Second conc.	66.1% Fe
Total recovery	95%

On some extensive deposits of metamorphic sediments of Brazilian Itabiryte iron ores (secondary crystalized hematite), High Tension beneficiation has again proved to be very successful. The following results have been obtained on such a sample (minus 48 to plus 200-mesh).

Feed	24.5% Fe
First conc.	64% Fe
Second conc.	65% Fe
Total recovery	86.5%

(*Continued on p 91*)



How Particles Respond to Corona Discharge

FIG. 2. Zone AB, through which the mineral particles are submitted to charge by contact with the drum and between particles, the conductors taking the same charge as the drum and the non-conductors an opposite charge:

Zone BC, where the particles are submitted to an intense ion bombardment which leaves all particles (conductors and non-conductors) with a net negative charge resulting in a strong pinning action. However, for the conductor particle, there is a rapid decay (discharging) of the charge and through the following:

Zone CF, where the particles are submitted to conductive induction charging, the conductors rapidly reverse their charge and reach their escape point (E_c) where they are lifted from the drum, while the non-conductors remain pinned to the drum and either reach an escape point (E_d) or may stay pinned to the drum through Zone FW, where there is no field action but where the non-conductor particles having acquired a steady charge through the ionic field are held to the drum by their "image force." Should this image force be greater than the weight of the particle plus its centrifugal momentum, the particle will remain pinned to the drum until detached by the action of the wiper (W).

Ionic charging in itself gives the poorest selectivity, but used in conjunction with induction charging it contributes to an excellent selectivity and an increased capacity of the separator.

From all these technical considerations, it is clear that with a given electric source (potential) we can affect a great variation of setting for the separator between:

(1) A "full pinning" setting in which the ionic field angle is set counterclockwise supplementary to the static field angle, practically eliminating completely the static field; (2) A "full lifting" setting in which the ionic field angle is clockwise equal to the static field angle and the ionic field is entirely eliminated; and (3) a "combination" setting selected to obtain the best selectivity between the minerals submitted to separation according to the rate of charge decay of the component conductors.

Lifting of conductors is very easily obtained in Zone AB, but should, in general, be avoided as it may result in excessive dusting and/or poor separation. The conductor particles lifted in this zone have a strong probability of colliding with the electrode, reversing their charge and bouncing back in all directions toward the grounded frame. This action is responsible for the accumulation of conductors (concentrates) that is often deposited on the feeding gate of the separator and neighboring parts of the frame, and may fall with the non-conductors and contaminate them. Reasonable care must be taken here.

From this explanation, it follows that the superficial conductivity of the mineral particles is the all important factor which affects the separation. Consequently, this separation is sensitive to any action which would alter the surface of the particles, such as would slime coating or any treatment affecting the exposed crystal structure and modifying its outer layer conductivity. As in flotation, reagents can effectively modify the behavior of a given mineral. Some sphalerite, for example, shows a non-conductor tendency which can be easily reversed by treatment with copper sulphate, thus restoring an excellent conductor behavior to this mineral.

As for the crystal surface conductivity, it is well known that it is essentially determined by the nature of the atomic binding of the crystal. Consequently, as far as predictability of the possibility of separation of two minerals is concerned, it can be stated in a general manner that minerals having Van der Walls or covalent bonds (good non-conductors) will be easily separated by High Tension treatment from the ones having metallic bonds (good conductors). However, a wide field for research is still open for the minerals having ionic bonds (poor conductors) which may be susceptible of separation after surface alteration or in variable frequency fields.

The success of High Tension is not limited to the American Continents and we have found excellent possibilities of application in Europe in the old Scandinavian iron fields, where results of treatment have been similar to the ones obtained in Canada and Brazil. In these Scandinavian fields, an unusually high amount of apatite and biotite (magnetic) is present and these two minerals can be easily eliminated by High Tension separation. On an ore (55% Fe) from Grangesberg (minus-48 to plus 200-mesh), we have obtained the following results:

First conc.	69.3% Fe
Second conc.	69.5% Fe
Total recovery	94.9%

In this case, biotite and apatite are the preponderant minerals of the tailings and their elimination was excellent (almost 90% rejected). Furthermore, if it is taken into account that the high concentration of biotite in the tails accounts for some of the Fe content of these tailings, the real practical recovery of metallurgical iron is even greater than that indicated in the concentrates.

Although it may not be economical for multiple reasons to beneficiate iron ores in which the satisfactory liberation of the hematite would require ultra fine grinding, we have done some work (of more academic than practical value) which has proven that good recovery can be obtained by High Tension treatment on extremely fine ground ores.

Such an ore, of South Dakota origin, had all been ground to minus 100 mesh (even a much finer grind would have been necessary to obtain satisfactory liberation) and the minus 600-mesh (hematite equivalent) slimes had been elutriated out under careful control. The following separation was then obtained by High Tension treatment of this (minus 100 to plus 600-mesh) ground ore:

Feed	30.3% Fe
Conc. plus 200-mesh	51.3% Fe
Conc. minus 200- to plus 600-mesh	60.7% Fe
Total recovery	72.2%

The indicated recovery of 72.2% on such a fine ground ore is certainly remarkable when one considers that the tailings still contain a large proportion of unliberated grains, true middlings, the beneficiation of which would require further grinding. As for the concentrates, screen analysis indicated, as shown in the table, that the minus 200-mesh accounts for the best grade and the largest amount of the recovery.

These results, which are of the same order as those flotation can give on this ore, clearly indicate that the High Tension technique is applicable to finely ground ores under the same circumstances as flotation (slim control) and can give very comparable results.

Acknowledgement

All data used in this paper are the results of laboratory test work and semi-pilot plant operations conducted, under our direction, at Carpco Research & Engineering, by R. T. Brooke, chief technician of our research department.

Samples of iron ores were supplied by the U.S. Steel Corp., Jones & Laughlin Steel Corp., Pickands, Mather & Co., Armour Research Foundation, Trafikatiebolaget Grangesberg-Oxelosund, and the South Dakota Industrial Development Expansion Agency.

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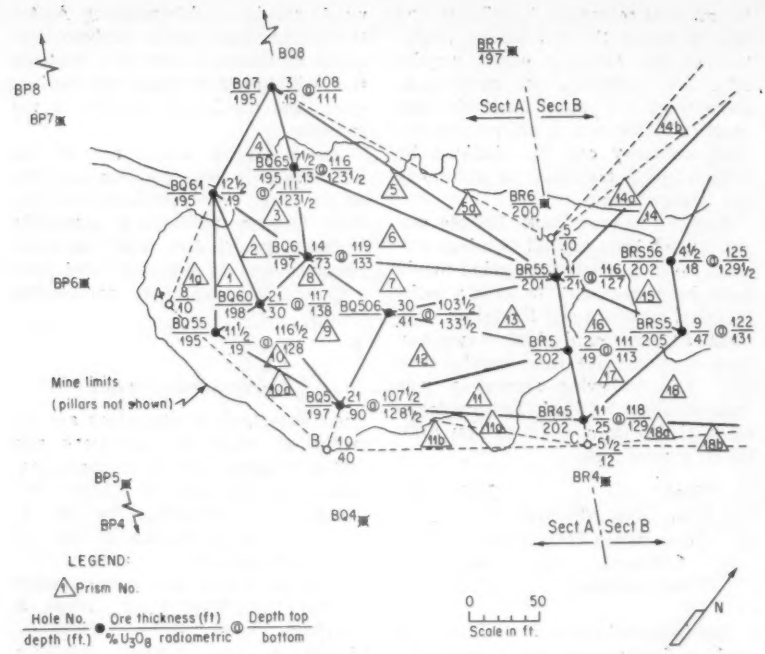


MAP OF OREBEARING AREA is divided into triangles to simplify calculations.

Thickness and Grade of Ore Is Determined for Each Hole

Depth	Assay Y-2	Assay YM-2
160.0		.07
160.5		.13
161.0	.07	.38
161.5	.09	.20
162.0	.11	.45
162.5	.27	.78
163.0	.45	.93
163.5	.64	1.60
164.0	.50	2.01
164.5	.34	1.08
165.0	.25	.51
165.5	.16	.34
166.0	.18	.33
166.5	.26	.43
167.0	.18	.35
167.5	.21	.30
168.0	.27	.22
168.5	.28	.19
169.0	.15	.16
169.5	.14	.16
170.0	.10	.17
170.5	.07	—
171.0	.05	.07
171.5	.06	—
172.0	.15	.06
172.5	.31	—
173.0	.12	.13
173.5	.09	—
174.0	.08	.06
174.5	.07	—
175.0	.05	.06
175.5	.03	—
176.0	.03	.10
176.5	.05	—
177.0	.09	.17
177.5	.09	—
178.0	.07	.17

12 ft at 0.22% from 162 to 174

9.5 ft at 0.56% from 160.5 to 170

How to Estimate Ore Reserves

HARRY J. WOLF

DETERMINING ORE RESERVES is one of the engineer's principal tasks when examining a mineral property. An examination, made in August 1957, of the uranium properties of Industrial Uranium Co. in northeastern Arizona gives a typical example of a simple and widely used method

Getting the Data

Prior to the examination, the operating company had done considerable exploration. This included the usual preliminary studies of the geological conditions of the region and the subsequent more detailed investigations of selected localities with the aid of such instruments as scintillators and Geiger counters and by chemical analyses of samples taken from local outcroppings of mineralized material. Following that the ground was explored by means of 4¼-in. dia vertical drill holes. Coring was found to be unreliable due to the crumbly nature of the material, particularly in areas with high vanadium content. In addition to the information obtained from drill holes, check samples were taken from drill core material where possible, and from underground workings as soon as the orebodies were opened by shafts, drifts, crosscuts or other workings.

The first holes were intended to locate ore deposits or channels. Following this, additional holes were drilled to determine the extent of the discovered orebodies. Then holes were drilled in rows, to crosscut the region wherein ore had been found, and to prospect for additional orebodies. The total number of exploratory holes amounted to 1,220 representing 146,450 ft of drilling. The average depth of all holes was 120 ft, ranging from 40 to 285 ft. Both Mahon and Failing rotary rigs were used. Cost per foot was $0.85.

The uranium content of the drill holes was determined by means of a Geiger counter and probing device manufactured by Uranium Engineering Co., based on long experience in the uranium industry. This practice is as follows: Prior to logging a hole, each machine is carefully calibrated against a sample of uranium ore of known content, within a steel tube attached to the machine. The probe containing the Geiger tube is then lowered down the hole, and readings are taken by a skilled operator. Readings of the observed values are recorded for each foot or half-foot of hole throughout the range of the ore. Properly calibrated and adjusted to the correct scale, the Babel counter indicates, by direct reading, the percentage of uranium oxide.

All holes on the Industrial Uranium Co.'s properties were logged, in addition, by a Government agency, using a high-class gamma-ray logging device which recorded the observed data on a graph in the form of a continuous chart. These data were recorded in counts per second, and may be converted to percent of uranium oxide by means of a calibration curve. The radiometric graphs obtained in this manner may be used to verify the accuracy of the company's probing results.

Analyzing the Data

The data obtained from each drill hole were studied and analyzed, to decide how much of each hole was in material that could be classified as commercial ore. The typical procedure is illustrated in the accompanying table. The portions of the holes which were in ore (based on indicated

Mr. Wolf is a mining and consulting engineer located in New York City.

assays ranging from say 0.05% U_3O_8 up) were thus measured, and the essential data (depth and % U_3O_8) were indicated at each hole as plotted on the map.

Hence, with information showing the positions of the holes, their distances apart, the thickness of the material rated as commercial ore, and the indicated assay in % U_3O_8, blocks of ground and their volume and average value can be calculated with an accuracy corresponding to that of the original basic data.

During this investigation, since the ore was opened underground at points where drill holes had penetrated the orebody, chip or channel samples were taken near drill hole locations and chemically analyzed. These served the purpose of checking the accuracy of the drill hole indications and obtaining any adjusting factor that could be applied to such indications. No adjustment was considered necessary.

Tabulation of Prisms Is Major Computation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Hole — Depth — Assay									Area	Depth	Volume		%
Prism	1st Hole			2nd Hole			3rd Hole			sq ft	ft	cu ft	Tons	U_3O_8
1	BQ61	17.5	.19	BQ55	11.5	.19	BQ60	21.0	.30	1,334	16.7	23,288	1,740	.236
2	BQ61	17.5	.19	BQ6	14.0	.73	BQ60	21.0	.30	1,350	17.5	34,125	2,545	.378
3	BQ61	17.5	.19	BQ6	14.0	.73	BQ65	7.5	.13	1,880	13.0	24,440	1,825	.372
4	BQ61	17.5	.19	BQ7	3.0	.19	BQ65	7.5	.13	1,783	3.3	16,581	1,238	.174
5	BR55	11.0	.21	BQ7	3.0	.19	BQ65	7.5	.13	4,598	7.1	32,646	2,440	.179
6	BR55	11.0	.21	BQ6	14.0	.73	BQ65	7.5	.13	5,454	10.3	58,903	4,400	.415
7	BR55	11.0	.21	BQ6	14.0	.73	BQ506	30.0	.41	3,150	18.3	57,645	4,300	.451
8	BQ60	21.0	.30	BQ6	14.0	.73	BQ506	30.0	.41	1,720	21.7	37,324	2,790	.443
9	BQ60	21.0	.30	BQ5	21.0	.90	BQ506	30.0	.41	3,869	24.0	73,656	5,500	.521
10	BQ60	21.0	.30	BQ5	21.0	.90	BQ55	11.5	.19	1,700	17.8	30,260	2,260	.512
11	BR5	2.0	.19	BQ5	21.0	.90	BR45	11.0	.25	4,065	11.3	45,934	3,430	.648
12	BR5	2.0	.19	BQ5	21.0	.90	BQ506	30.0	.41	4,620	17.7	81,774	6,100	.596
13	BR5	2.0	.19	BR55	11.0	.21	BQ506	30.0	.41	3,120	14.3	44,616	3,330	.349
1a	BQ61	17.5	.19	BQ60	21.0	.30	A	8.0	.10	1,349	15.5	23,280	1,736	.225
10a	BQ5	21.0	.90	B	10.0	.40	A	8.0	.10	2,325	13.0	30,225	2,270	.608
11a	BQ5	21.0	.90	BR45	11.0	.25	C	5.5	.12	1,575	12.5	19,687	1,465	.595
11b	BQ5	21.0	.90	B	10.0	.40	C	5.5	.12	2,775	12.1	33,577	2,500	.645
5a	BR55	11.0	.21	BQ7	3.0	.19	J	5.0	.10	3,960	6.3	24,948	1,860	.178
	Tonnage, and average % U_3O_8												51,729	.453

Making the Calculations

The first step in estimating ore was to divide the ore-bearing area into arbitrarily chosen triangular prisms with a drill hole at each corner, for convenience in making calculations (see map). From the data available, the volume and average assay value of each prism of ore was estimated separately. Then the separate estimates were summarized. This method served to reduce or almost eliminate any cumulative error which might otherwise develop in making calculations of this nature.

All ore reported in these estimates was classified as "ore blocked out" or "positive ore."

All essential information regarding each prism of ore which enters into the estimates of reserves was tabulated so that it could be readily checked and analyzed. Each tabulation consisted of 15 columns of figures, which may be explained as follows (see table):

Column 1 indicates the number of each individual prism of ore.

Columns 2, 5 and 8 present the numbers of the individual drill holes which mark the three corners and vertical edges of a prism of ore. These corners appear on the drill-hole map.

Columns 3, 6, and 9 show the vertical thickness of the ore at the vertical edge of each prism; in other words, the number of feet of drill hole which passes through material rated as commercial ore at this point.

Columns 4, 7, and 10 present the average assay value of the material penetrated by the hole, expressed in percentage of U_3O_8.

Column 11 shows the area of the horizontal cross-section of the prism of ore under consideration. This area is found by scaling the dimensions of the triangle on the drill-hole map which is sufficiently accurate for all practical purposes.

Column 12 shows the average depth of each ore prism in feet. It is one-third of the sum of the three vertical edges of each prism.

Column 13 shows the volume of ore in each prism, expressed in cubic feet. It is the product of the figures in Columns 11 and 12.

Column 14 shows the tons of ore in each prism. It is found by dividing the figure in Column 13 by the number of cubic feet of ore in one ton of 2,000 pounds. In this case 13.4 cubic ft of Shinarump sandstone ore, in place, weighs one ton.

Column 15 presents the average U_3O_8 content of each prism of ore, expressed as a percentage of the weight. This is found by multiplying feet times grade for each of the three holes, totaling the three values and dividing by the total feet of the three holes.

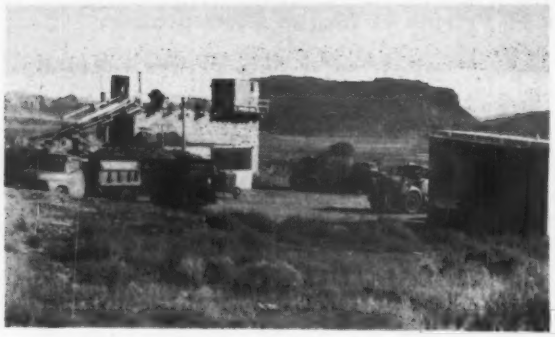
The total indicated at the bottom of Column 14 is a simple arithmetical sum.

The figures at the foot of Column 15 represent the properly weighted average of all the ore in the individual prisms listed in the tabulation. This is done by summing up tons-times-grade for all prisms, then dividing that sum by the total tons.

It should be noted that at the fringes of the deposits, where common practice based on experience permitted, ore was assumed to extend beyond the outermost ore hole (dashed triangles on the map). For calculating prisms, a ficticious drill hole was placed on the map. The value of its grade and thickness was based on a straight line variation between the last ore hole and the first blank hole.

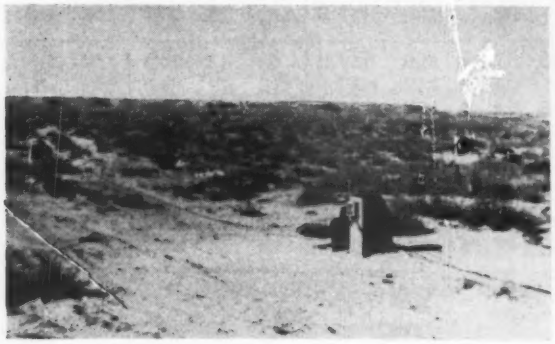
In this case, following the computation of the major ore bearing areas of properties, a further review of one of the orebodies indicated justification for the estimation of additional ore having a value of about 0.20% uranium oxide. The reason for including additional ore of this grade was that it constituted a product useful and desirable for purposes of blending with higher grade ore, in order to meet certain marketing conditions.

[Ed.—This scheme of estimating volume of ore from drill holes is usually called the "average area and depth" method. One variation, usually called the "area of influence" method, uses polygonal prisms formed around each hole by perpendicular bisectors of lines connecting holes. Another method using vertical or horizontal sections and interval can be used for holes drilled in parallel planes. (See US Bur. Mines Bull. 356 and various texts on field geology and mine examination.)] *(Continued on next page.)*



MOONLIGHT INCLINE is location of mine buildings.

STARLIGHT SHAFT has similar tipple and ore dump.



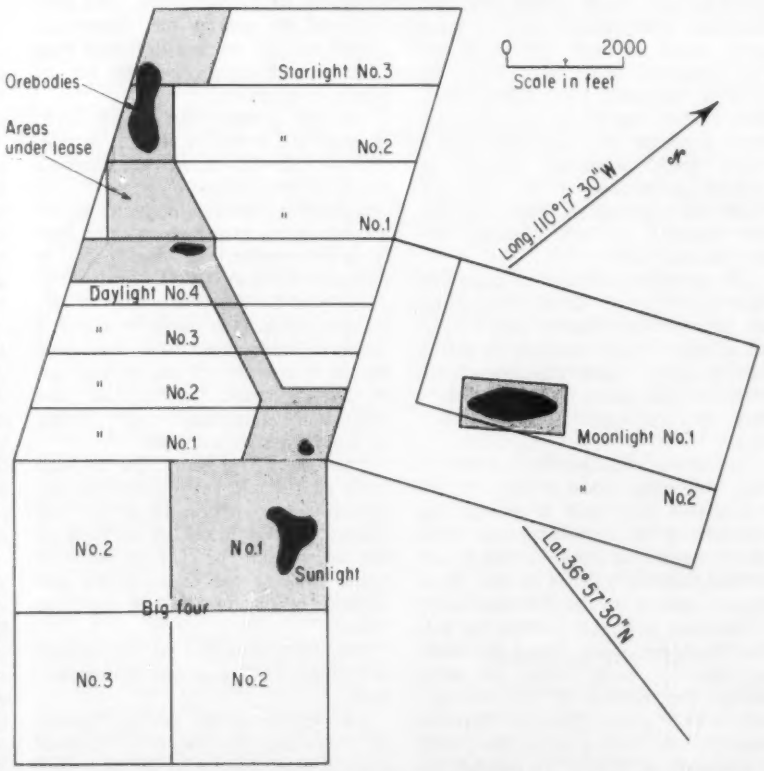
VENTILATION is aided by exhaust fans on drill holes.

ORE HAULAGE to mill is by 30-ton truck-and-trailers.

Mining Is Typical Of Colorado Plateau

Industrial Uranium Co.'s property comprises about 400 acres in El Capitan Flat, Monument Valley, northern Arizona, about 60 miles west of the Four Corners and three miles south of the Utah state line. It is operated under lease from the Navajo Indian tribe, specifying a long-term agreement on a sliding scale royalty based on grade of ore produced and sold. The property has been prospected with about 1,200 vertical drill holes, about 500 of which have blocked out three principal orebodies containing some 650,000 tons averaging 0.30% U_3O_8. Three mines have been opened and are currently producing about 4,000 tpm.

The ore deposits are at the base of the flat-lying Shinarump conglomerate, about 100 to 200 ft below the surface. Deepest ore is about 250 ft below the surface. The thickness of ore ranges from 2 to 47 ft with an average range nearer to 5 to 21 ft. The uranium oxide content of mineable thicknesses of ore ranges from 0.20 to 0.60% and higher. The ore also contains some vanadium and minor amounts of copper. It has been leached of calcium carbonate — the mineral cementing material of the



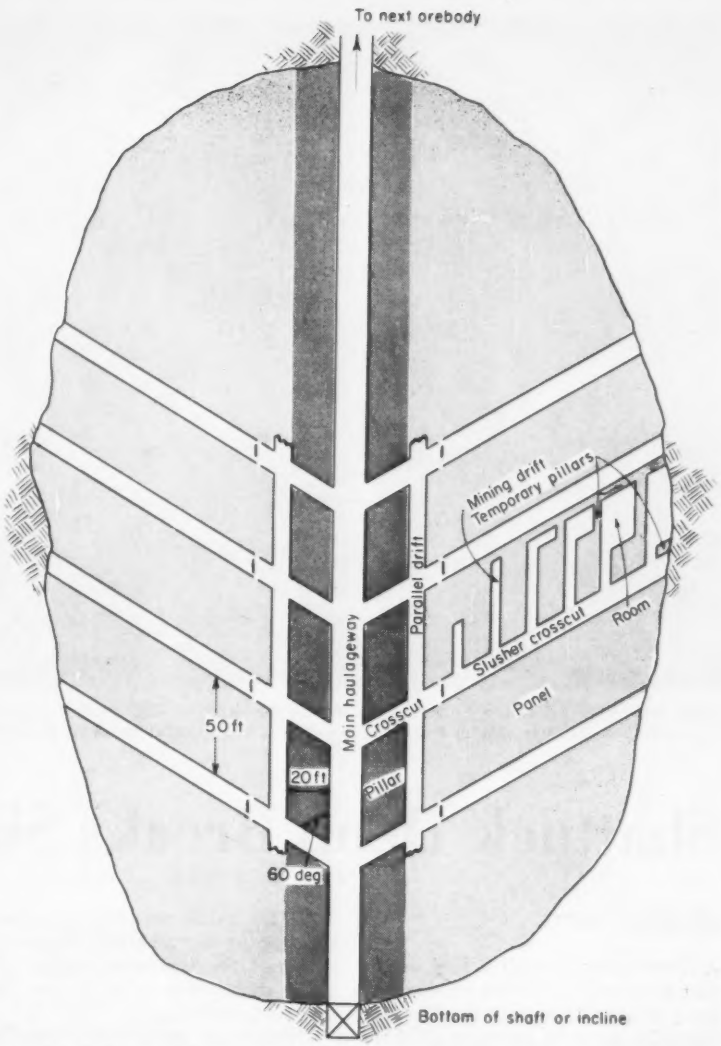
CLAIM MAP locates orebodies and areas leased by Industrial Uranium Co. from Navajo Tribe in northeastern Arizona. So far drilling indicates some 650,000 tons of ore averaging about 0.30% is in the orebodies. Ore is shipped to the Texas-Zinc mill at Mexican Hat, Utah, about 30 miles northeast of the mines.

host rock — resulting in a fine, friable material of only about 1.4% lime as mined. The ground immediately above the orebodies is mostly hard and firm. Mine drainage requires pumping of only about 30 gpm at the most fully developed location and only 70 gpm maximum at any of the three mines.

Access to the Moonlight mine, now in production, is by a 16-deg inclined shaft 7x8x385-ft (136 ft vertical). The Starlight and Sunlight mines, under development, have two-compartment vertical shafts. The Starlight shaft is 4x8½x180 ft and the Sunlight, 4½-x9x260.

Mining method is irregular room-and-pillar. Haulage levels are driven along or just under the bottom of the ore deposits. Air leg machines are used for drilling. Slushers are used for gathering and loading along with overcast mucking machines. Loaded mine cars are hand-trammed to shaft bottoms and hoisted one at a time—directly by the hoist rope at the Moonlight mine and on cages at the other two mines. The ore is dumped on surface stockpiles adjacent to the tipples. A front-end tractor-shovel is used to blend-load ore into motor truck-and-trailer units of 24- to 30-ton total capacity. Ore is hauled about 30 miles to the Texas-Zinc Co. mill at Mexican Hat. Mine headings are ventilated by 1,000-cfm exhaust fans at the collars of 8-in. dia vertical drill holes which are periodically drilled as the headings advance.

Mining costs are reported to be $6 to $7 per ton. Trucking is contracted at about 8½¢ per ton-mile. Selling price of the blended ore (0.30% U_3O_8 is $25.50 a ton before initial production bonus and allowances for haulage and vanadium. Haulage allowance is 6c per ton-mile.

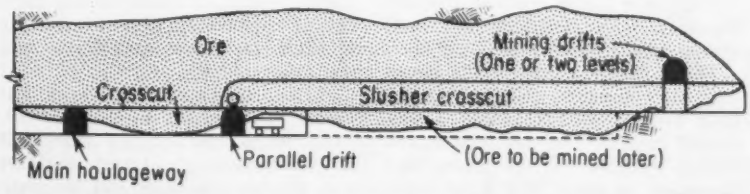


LAYOUT OF PROPOSED MINING SCHEME has regular rooms, pillars and panels. Each panel retreats from edge of orebody toward center haulageway. Protective pillars along haulageway are not robbed until mine is being abandoned.

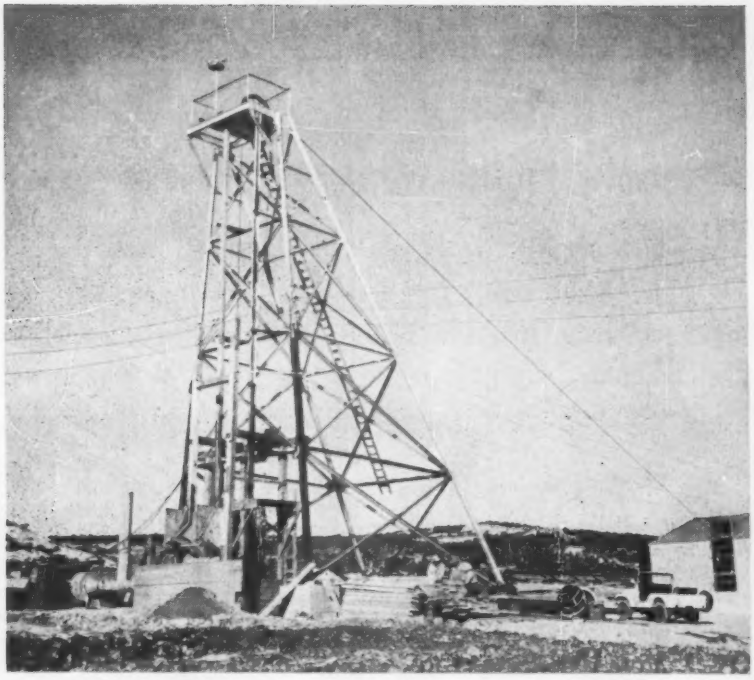
Proposed Method Is More Systematic

A mining method aimed at reducing any threat of future dilution or loss of ore was proposed for these orebodies. First, a single longitudinal main haulageway should be driven from the shaft, partially in rock if necessary, on a slight upgrade to favor drainage and haulage and at a level low enough for mining by overhand or breast stoping to gain the aid of gravity in loading. Crosscuts should be turned at a uniform angle for better haulage. Rooms, turned off the crosscuts, should be mined on a retreat from ore limits using slushers to move the ore. Pillars should remain until the lowest horizontal slice of ore has been mined.

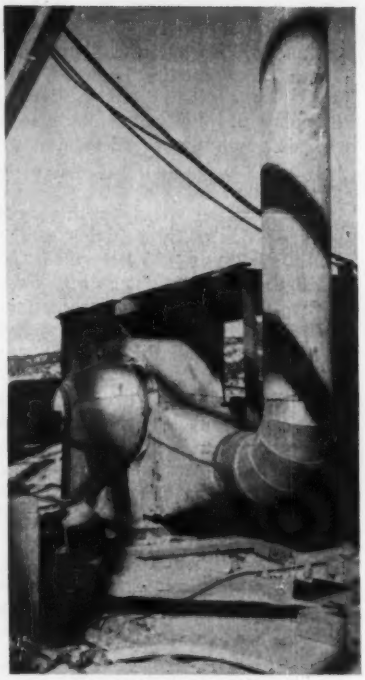
FROM PARALLEL DRIFT, crosscut continues only a short distance at the level of the haulageway. Remainder of crosscut steps up for slusher loading.



FROM CROSSCUT, entire panel is mined in horizontal slices from top down. Temporary pillars around rooms are maintained until after lowest slice is mined.



THE BARDON SHAFT employed a three-piece ensemble of drill jumbo, skip and Cryderman mucker to sink to 850 ft in San Juan County, for a uranium producer.



7500-CFM FAN exhausts air from shaft, permits re-entry within eight minutes.

Shattuck Denn Breaks Sinking Records

JOHN B. HUTTL

A HIGHLY MECHANIZED sinking operation of a small shaft was expected to bring in a new record at the Shattuck Denn Co. property, southeast of Moab in San Juan County, Utah. Target date for the arrival at 850 ft using a three-unit ensemble was Nov. 10. Unexpected water inflow delayed it. (see p 18).

The core of the operation consists of a 4½-ton Cryderman mucking machine, a unique 4-machine umbrella-type drill jumbo weighing 1½ tons, and a 70-cubic-ft dump skip. The ensemble is completed by a 4,500-cfm turbo blower installed on the deck above the operator's cab of the Cryderman and a 7,500-cfm exhaust fan on the surface a short distance from the manway.

The latter factor enabled Shattuck Denn to send men into the shaft within eight minutes after each blast.

The $375,000 Bardon shaft, named after the company president, is being sunk to develop and exploit a substantial uranium orebody lying in the bottom portion of the Shinarump formation at about 850 ft. A main station will be established at 825 ft in the shaft.

E&MJ visited the property in early October to see how the ultimate in modernization was being applied to a small shaft. (The cross section, untimbered, measures only 13x7 ft.)

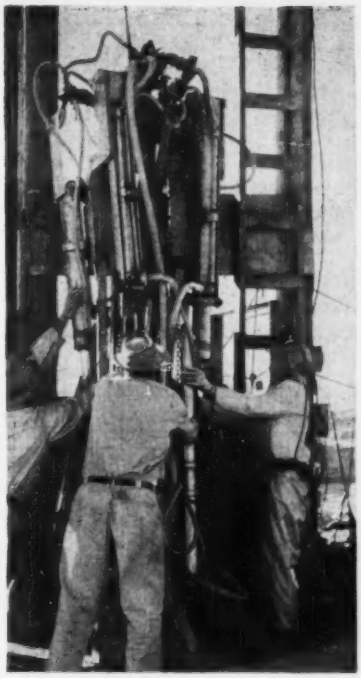
Decision to move away from former shaft sinking practices was dictated by the need for speed in finishing the job. T. W. Newell, vice president and manager and his able staff investigated and studied every new shaft-sinking method and piece of equipment before selecting the ensemble which they thought would do their job best.

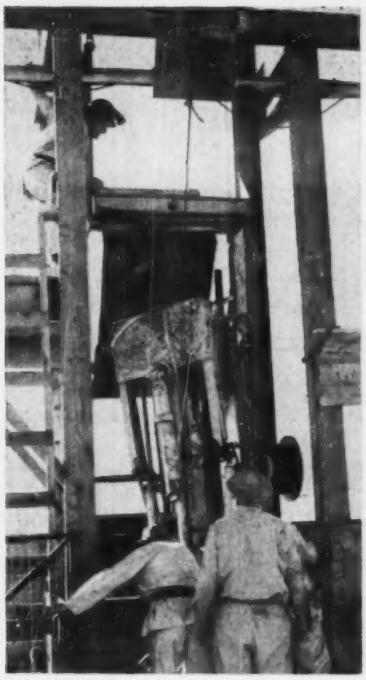
The technique and equipment used is the result of close collaboration and consultation with officials of Machinery Center, Inc., of Salt Lake City, whose subsidiary, Shaft & Development Machines, Inc., handles the Cryderman. F. W. Garrett, general superintendent, is credited with a number of engineering ideas toward the practical use of the special skip and the drill jumbo.

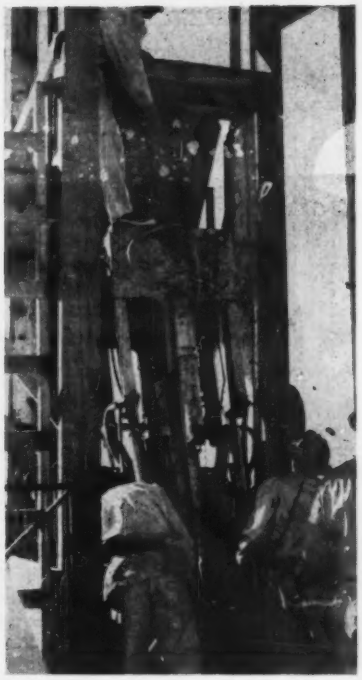
Preliminary construction work was started at the shaft site on June 10, 1958, with crew leveling shaft and surface plant sites and preparing cuts and fill for structures and concrete foundations. On June 15, a B-E crane was moved in. Compressors, hoist, 52-ft steel headframe, motors, transformers, diverse camp buildings, and others arrived soon thereafter. The entire surface plant was completed Aug. 7.

The shaft proper was sunk to a depth of 85 ft during the construction period, with the crane equipped with clamshell serving in place of a headframe whenever it was freed by the construction crew. The raw shaft was timbered immediately after installation of the headframe and hoist, and its collar concreted. In view of the fact that the Cryderman unit with superstructure housing operator's cab and platform with tugger hoist and turbo blower above is about 35 ft long, a minimum distance of 65 ft had to be sunk before it could be employed underground.

After timber operations had been completed, the mucker was lowered into the manway compartment and attached to a steel yoke by means of a double sheave block assembly actuated by the tugger hoist mentioned. The drum of the tugger accommodates sufficient cable to raise and lower the Cryderman unit over a maximum distance of 60 ft. Special skids guide the Cryderman in the manway compartment. The 8-ft cen-





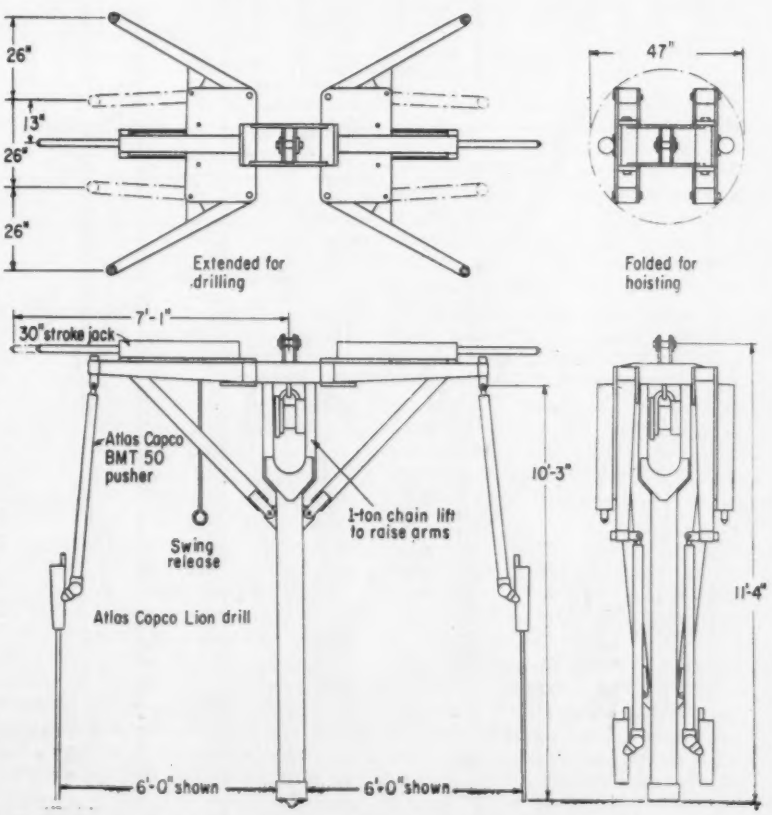


FOLDED DRILL JUMBO, suspended from cable of tugger hoist at side of shaft, is eased into position for lowering to the shaft bottom. Umbrella-like unit folds to 47 in. wide for the trip down, opens on the bottom for four-drill placement.

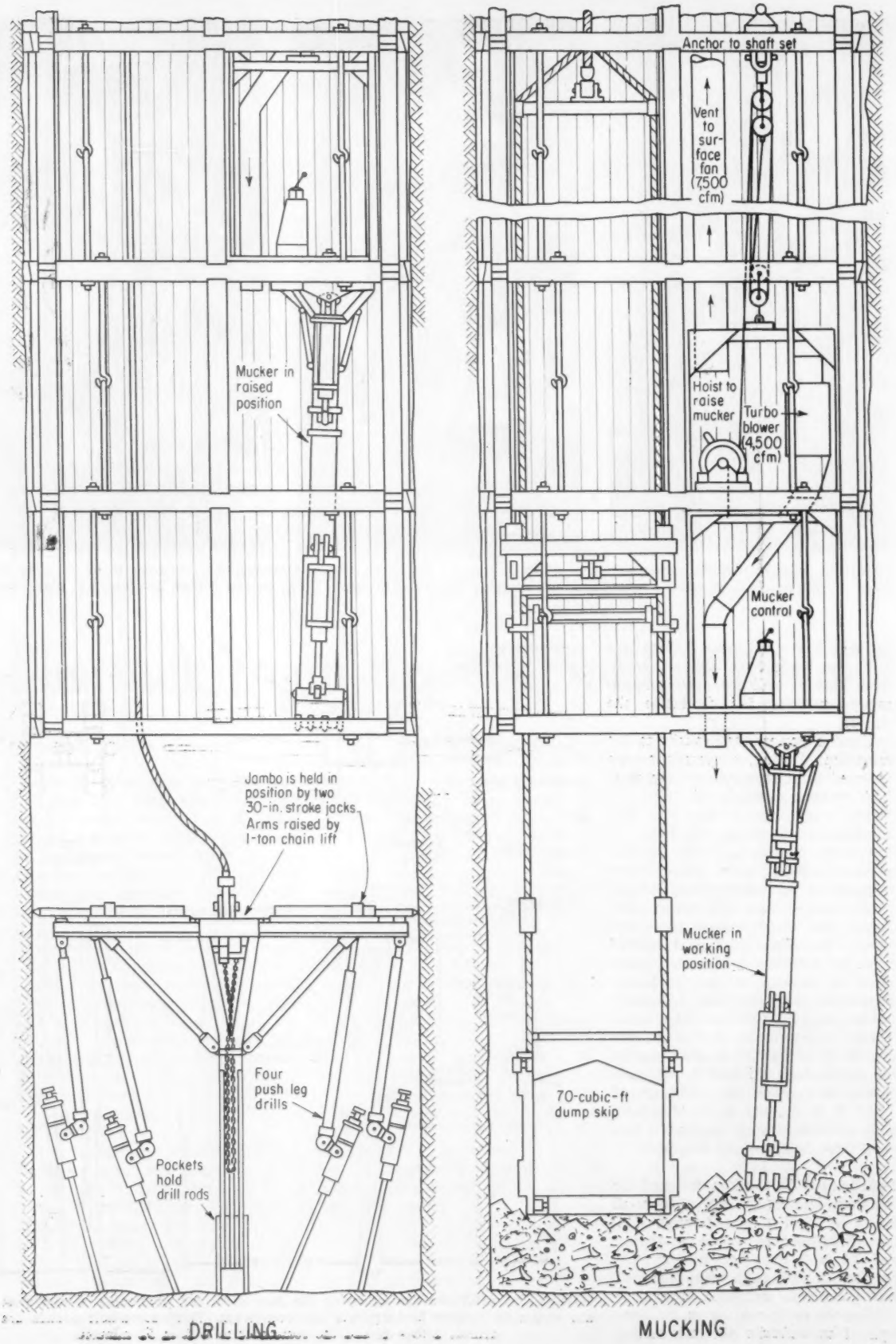
ter shaft sets with Coeur d'Alene-type laces are made from 8x8-in. timber. Both hoisting and manway compartments measure 5x5 ft inside the timber.

Electric power was brought to the mine Sept. 1. Sinking operations were resumed and continued until the shaft had reached a depth of 109½ ft. Work was stopped Sept. 5. The Cryderman was then pulled out of the shaft to change skids to the opposite side and reset turbo blower preparatory to commencing all-out mechanized sinking with special drill jumbo and skip received from Salt Lake City. This work was started Sept. 14, with the newly hired crews given a day or so to familiarize themselves with the new equipment before going on a formal bonus basis. These crews sank the shaft a distance of 392 ft to the 502-ft mark during the period Sept. 15 to Oct. 10, indicating an average daily advance of 15.68 ft of finished shaft. Maximum daily advance during this period was 24 ft with the three-unit ensemble.

Drill jumbo. This unit is designed for handling four drills, has an over-all length of 11 ft 4 in. and weighs 1½ tons. Width when folded is 47 in., and 14 ft 2 in. when in operating position in shaft and with points of lock jacks fully extended. The arms holding the drills operate on the principle of an umbrella rib, their raising



UMBRELLA-LIKE mechanism opens the four drills for positioning. Center post has welded-on pockets to keep drill sets convenient. Thirty-seven-hole rounds are drilled, 2 to 4 ft and the remainder to 6 ft in 52 minutes.

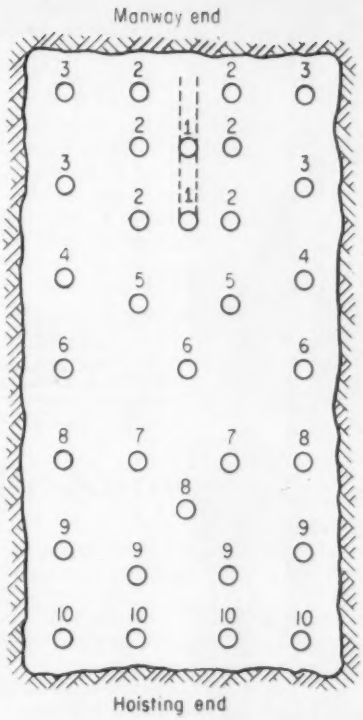

Anchor to shaft set
Vent to surface fan (7,500 cfm)
Mucker in raised position
Hoist to raise mucker
Turbo blower (4,500 cfm)
Mucker control
Jambo is held in position by two 30-in. stroke jacks
Arms raised by 1-ton chain lift
Mucker in working position
Four push leg drills
70-cubic-ft dump skip
Pockets hold drill rods
DRILLING
MUCKING

and lowering being done by a 1-ton chain lift. The center trunk of the jumbo has welded-on pockets for storage of drill rods and tools. Drills used are Atlas Copco Tiger push drills with the retractable legs attached to the end of each arm by fork joint. After a round has been drilled, the complete jumbo assembly, including drills, is hoisted to the surface and removed from the skip compartment by a tugger hoist installation temporarily forming part of the headframe.

Cryderman mucker. Consists of an ingenious digging element proper and a superstructure with skids housing the operator's cab, turbo blower, and tugger hoist to lower and raise to any desired point. Action of the digging unit resembles that of a giant hand or claw. The positive action and flexibility of operation offered makes possible removal of 95% of rock broken after the blast, leaving only 5% for hand cleanup. Use of the drill jumbo special skip assembly, and novel ventilation system in conjunction with the Cryderman has upped its availability from an average 25% to 50%.

Skip assembly. This consists of a conventional dump skip of 70 cubic ft capacity temporarily severed from the crosshead, steel bridle, and a crosshead fitted with special release and lock mechanisms at each end near the safety dogs. The skip proper is suspended from two steel cables attached to the bridle held by the hoisting rope. It can move freely between the crosshead once the crosshead has been locked by safety dogs at desired point in shaft by torpedo units on each cable just above the skip top slipping out of the lock-and-release mechanisms and simultaneously freeing the cables. This permits the skip to be lowered to the bottom of the shaft for loading while crosshead is in locked position. After the skip has been loaded by the Cryderman, it is raised slowly until the torpedo units slip into the lock-and-release mechanisms, thereby releasing the safety dogs and at the same time holding the skip close to the crosshead and at set distance for subsequent hoisting to surface and automatic dumping.

Ventilation. The turbo blower and exhaust fans are in constant operation. Fumes generated after each blast are cleared from the shaft bottom in about five minutes and the men return to the work area in eight minutes. To obtain optimum operating efficiency, it is important that the intake of the Cryderman blower be slightly above the tip of the exhaust fan intake vent at all times. In general, the fumes generated by each blast never rise higher than 20 ft above the floor of the shaft.



Typical Shaft Round

EACH ROUND is designed to kick muck to the manway end of the shaft near Cryderman, away from the skip.

Sinking Operations

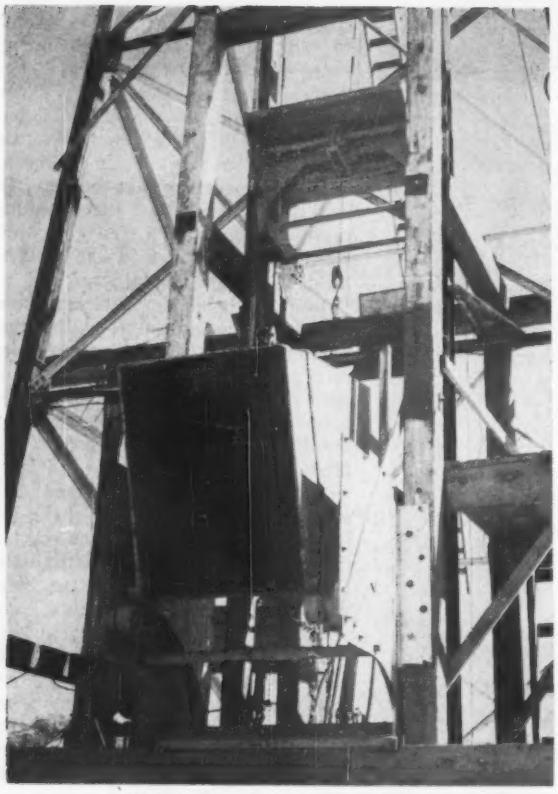
The complete cycle of drilling, blasting, and mucking requires 2½ hours. Generally, three 6-ft rounds are completed during a 24-hour period, the remaining 16½ hours being used for timbering, and extending fan vents, ladders, air, power, and water lines. Although 8-ft or deeper rounds are quite possible, Mr. Newell believes that the 6-ft round offers better and surer breakage with consequent reduction of slow-ups due to poor breakage of deeper rounds. In view of the platforms available above the skip crosshead and near the top of the Cryderman superstructure, no staging to carry out timbering and other tasks and no bulkheads to protect miners on the floor of the shaft are required at any time. Nor are "battleships" needed to protect timber during blasting. The height of open shaft is held at about 18 ft.

In the shaft a V-cut type of round (V-cut on manway end) of 37 holes is used. Save for the preliminary lifter holes which are drilled to a depth of 4 ft, all remaining holes are put down 6 ft. Drills used are Atlas Copco Tiger units using Sandvik Coromant 1-in. steel rods fitted with chisel bits with tungsten-carbide inserts designed to drill holes 1½ in. in diameter. Four machines are attached to the drill jumbo arms and the operating crew consists of two men. The drill steel used is carried in the pockets welded onto the jumbo trunk.

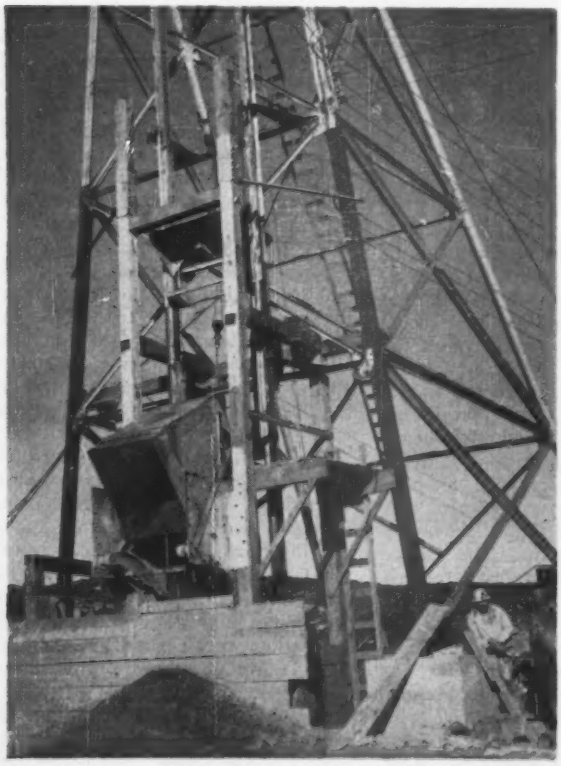
Blasting is done with du Pont 40% gelatine dynamite, each stick measuring 1¼x24 in. Two sticks are used per hole, providing a power column of 4 ft. The remaining 2 ft of hole is allowed to fill with water to serve as tamping. Loaded rounds are fired electrically from the surface, with the V-cut being detonated first and the following rows of holes at intervals controlled by use of regular delays. This tends to throw the bulk of the broken material under the manway side of the shaft within easy reach of the Cryderman mucker. Under normal breakage the broken rock lies at an angle of 45 deg after the blast, leaving adequate room at the lower or hoist compartment end for the skip. The Cryderman commences loading operations about eight minutes after the blast.

Time required to carry out the different steps making up the sinking cycle is as follows:—About 10 minutes to transfer drill jumbo to hoist compartment by tugger hoist installation; 8 minutes to lower drill jumbo and position it for drilling; 52 minutes to drill out the 6-ft, 37-hole round; 20 minutes to blow out holes, load powder, and string firing lines; 40 minutes for Cryderman to load 95% of broken material, or about 17 skips, into skip and hoisting to surface; and 20 minutes to hand-muck 5% of remaining broken material into skip and hoisting to surface, or about 2½ hours for each complete sinking cycle. The sinking crew consists of three men in the shaft, including the leader, hoist man and service man.

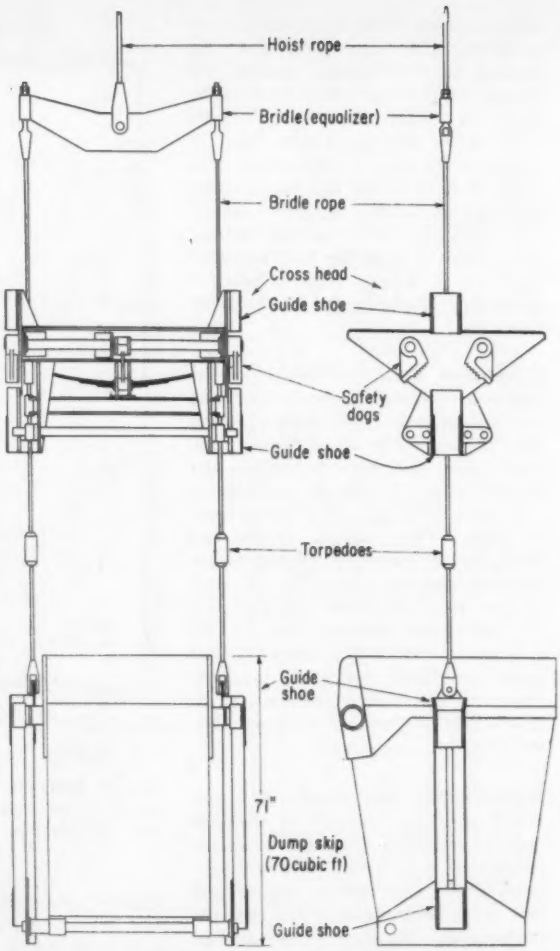
Principal surface plant structures include a steel hoist-compressor house containing a 200-hp single-drum Denver Vulcan hoist with rope speed of 700 fpm and using ⅞-in. steel rope, and an I-R Imperial Type 10 compressor and a Sullivan angle-compound compressor; 52-ft steel headframe; repair shop; warehouse; timber framing facilities; several housing units; office; mess hall; and others. Electric power is obtained from the Utex substation of Utah Power & Light Co. via a new 16,000-v power line eight miles long. The shaft made relatively little water at the time of



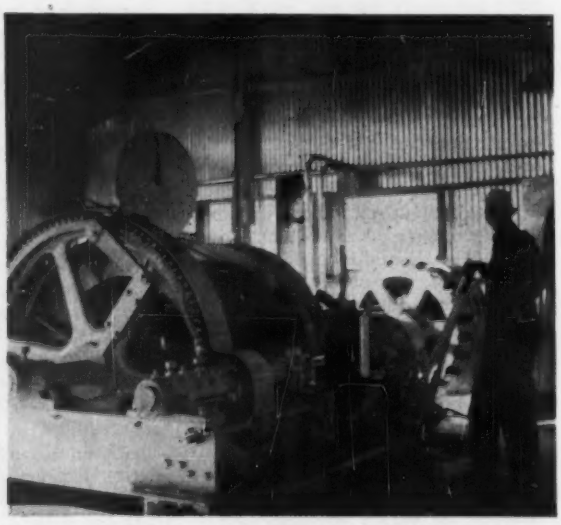
70-FT SKIP dumps load after trip to the surface. About 17 trips are required to muck out the shaft before drilling.



SAFETY-DOG arrangement on skip ensures efficient, careful operation. About 95% of muck is removed by the Cryderman.



CROSSHEAD is kept in locked position in the shaft while skip is lowered alongside muck pile for loading. Cryderman loads about 95% of broken material into the skip in 17 trips, remaining 5% is hand-loaded. About one hour is required for loading, total operation takes about two and one-half hours.



A 200-HP single drum hoist (Vulcan Iron Works, Denver) moves skip, jumbo, men and materials during the operation.

E&MJ's visit, but pumping facilities were available to take care of any moderate inflow. At the indicated rate of advance, the shaft was scheduled to be completed Nov. 10. (See p 18.)

Shattuck Denn is operating the property under a lease agreement entered into with Kerr-McGee Oil Industries, Inc. early in 1958.

Current mineral holdings were first staked by Hancock and Bowen in 1953, with several interests doing exploratory drilling after discovery. A comprehensive drilling campaign started later by Kerr-McGee and Anderson Development Corp. lead to the discovery and delineation of the orebody to be exploited. The area was subsequently re-drilled by Shattuck Denn to verify the drilling done by Kerr-McGee, followed by a deflection survey on holes to determine the relative position between the tops and bottoms of the holes drilled. The company is spending about $375,000 on the new shaft, underground facilities, surface plant, and equipment.

The orebody drilled out is a very composite and continuous structure striking east and west. Dip is about 11 deg to the south. It lies in the lower portion of the Shinarump formation, with the Cutler formation as footwall. Width and height average 250 ft and 7 ft, respectively. The shaft on its way down to the ore-bearing horizon passed through the following formations:—About 115 ft Keyenta (relatively hard); 325 ft Wingate (tightly consolidated sandstone); 340 ft Chinle (loosely consolidated shale carrying bentonite. Spalls when wet); and 40 ft Shinarump.

Operations are directed by T. W. Newell, vice president and manager, Shattuck Denn Co. Executive members of his staff include F. W. Garrett, general superintendent; Leo Zitnik, foreman; C. W. Appelin, engineer; and J. D. Hill, office manager.

Mining—the Little-Known Industry

IN SOME RESPECTS mining is one of the least known, least understood of the major industries. The reams of information published in mining magazines, government reports, company reports, etc., go to perhaps less than 1% of the population. Lack of public knowledge on mining is in part due to the remote location of mining properties, and in part due to reluctance of mining companies, in the past, to release information to the public.

And yet, the general public is intensely curious about mining. Here in New York, editors receive a steady stream of requests such as these: How many motors are used in the mining industry? Where can I get some lepidolite? What is the market for turbine engines in the mining industry? What's going to happen to the price of copper? These queries come from would-be prospectors, investors, banks, equipment manufacturers, metal and ore buyers, non-mining companies seeking to diversify or to produce their own raw materials, business men, reporters, etc. If we had statistics such as the more widely known automobile industry publishes, it might be easy to answer some of the questions. But unfortunately there are serious gaps in the statistical information available on mining, despite all the valuable information which Government agencies and industry organizations have provided.

How *E&MJ* Plans to Help

E&MJ will mail out questionnaires to all mining companies or units to gather information and statistics not now collected or reported by any Government or industry agency or organization.

Because of the magnitude of this research project and the time and expense involved, the census is planned in two stages:

1. An over-all classification survey of every active mine, mill, smelter, refinery or other mineral processing plant in the U.S. Data will be placed on IBM punch cards, tabulated, and analyzed and released for industry use in the editorial pages of *E&MJ*.

Information requested in the first-stage survey will include such items as name and location of a mine or plant, location of head office, type of mine or processing plant, principal metals or minerals mined, capacity of mine or plant, number of men employed, company officers, important managerial and operating personnel, and similar vital information about operating units in the mining industry. This information will be used to up-date a directory of principal mining units which is maintained for parties seeking facts about the mining industry.

2. A series of specific research studies of phases of operations of most importance such as drilling, loading, haulage, power applications, crushing, grinding, flotation, other mineral processing operations, etc.

Operating data will be regarded as confidential, but it will serve a useful purpose in determining trends in the mining industry with reference to such subjects as ground support methods, techniques in the use of explosives, types of equipment in use, performance data, new developments, etc. All of this information will be returned to the mining industry in the form of mining review articles, special reports on certain techniques, and articles which will enable the reader to check his operating efficiency or methods against industry patterns as revealed by the surveys.

The questionnaires will also give mine operators an opportunity to call attention to any new techniques which have been adopted at a property; also space for comment on ways in which we can make the surveys more useful.

We Will Need Your Help

The questionnaires have been designed for speedy fill in in order not to burden those who fill them in. Postage-paid return envelopes will be provided. When the questionnaires arrive at your property will you please have staff members fill them in and return them as soon as possible. We particularly invite the cooperation of local mining secretaries and State mine inspectors, with a view to returning useful information to these officers concerning the mining industry in their areas.

Important Benefits

Classification and interpretation of the information requested will enable us to inform the public about certain phases of the mining industry not now available. It will be useful to companies seeking to buy raw materials. Certain data will be useful to some of the mining industry's best customers—the automobile manufacturers, who are constantly making surveys of mineral resources; the battery industry, which consumes the major portion of lead production; and the electrical manufacturing industry, which is a leading customer of the copper industry.

With continued development, this system of polling the mining industry might aid in pointing up management trends such as the formation of new industrial engineering departments, or determining capital spending trends which are important to companies which finance mining ventures. See report on page 18.

BLIND SCREENS can effect entire plant operation. One remedy is to install low-voltage resistance screen heaters to reduce blinding and restore efficiency.

How to Reduce Screen Blinding

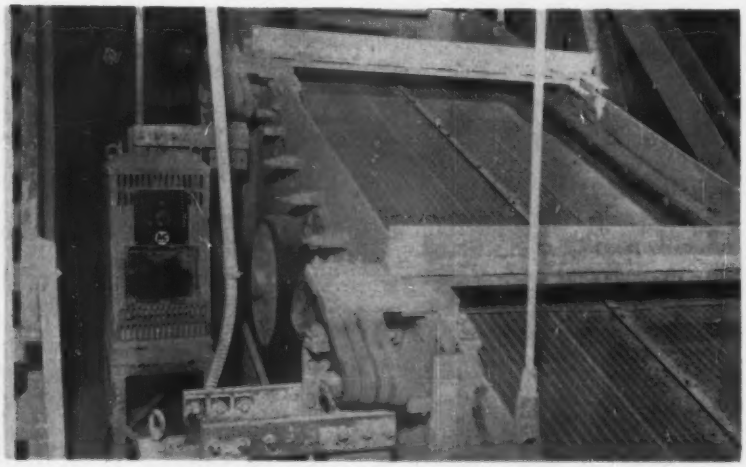
J. E. FINK

ELIMINATION OF SCREEN blinding is a serious but not impossible task. The key to the remedy is in the approach and the result is increased production at reduced costs.

Plant efficiency depends on screen performance. The all-important vibrating screen classifies the plant's entire feed material by difference in size, either by separation of coal, iron ore, or aggregate into various size groups or by washing or de-watering material.

If for any reason the openings in the screen surface (or deck) should become fully or partially plugged, the whole machine becomes less effective and ultimately results in increased production costs and decreased profits. Let's look at blind screens to see what can happen.

Mr. Fink is supervisor of aggregates, ore and paper pulp screens, Allis-Chalmers Mfg. Co. Process Machinery Dept., West Allis Works, Wis.



SCREEN HEATERS evaporate moisture and allow the screen to shake out the dry particles. Partially blind or blind screens will cut down a plant's capacity.

In extreme cases, completely closed screen openings prevent any material at all from passing through the deck.

Even partial blinding proportionately reduces available screen area. To compensate for reduced screen area, the feed rate must be held back or screen efficiency will not be maintained.

Indirect costs rise right along with blinding. In addition to the labor costs for brushing or pounding the screens to clean them, production time lost during cleaning becomes a costly item.

Fortunately, most causes of screen surface blinding can be definitely determined and, with a proper approach, can be just as definitely remedied.

Blinding of screen surfaces is generally due to one of three easily ascertained causes: improper operating characteristics of the vibrating screen; moisture present in the material being screened on finer meshes, and irregular particle shape of the material being screened.

The important operating characteristics of a vibrating screen are speed or frequency of vibration, amplitude of motion, direction of rotation, and slope of screen surface. If the screen supplier has been completely apprised of the use for the screen, he will arrange for the proper combination of speed and amplitude. Should an inclined screen be wanted, he will also recommend the correct slope at which it should be installed and specify the direction of mechanism rotation. Larger amplitude of motion will be correlated to respectively larger screen surface openings.

Screen Characteristics

The table gives the operating characteristics recommended for some typical inclined screens.

When an existing screen is to be used for an application other than that for which it was originally intended, it would be well to check with the screen supplier to see if it needs modification, to make it more suitable for the new service.

Increases in amplitude and speed should be made only after approval of the screen supplier to avoid overloading bearings. At the same time, the supplier can also check the mechanical construction of the screen to make sure it is structurally suitable, particularly if the new application is more severe.

Blinding due to moisture in material usually is the most troublesome with openings up to 3/8 in. The moisture in the material causes the fines to cling to the wires of the screen surface as well as to the other fine material. This

build-up of fine material partially closes the openings in the screen surface, and in some cases may completely close them.

This trouble can sometimes be alleviated or overcome by changing the screen surface from a square opening to a rectangular opening wire cloth. Frequently, more drastic action, such as knocking the fines off the screen surface by impact or heating of the screen surface, is necessary.

Where blinding due to moisture in the material is only occasional, it can often be overcome by manual means, such as brushing the cloth or striking it with a hose to dislodge the damp material. However, the labor involved can become an expense if moisture in the material is a common occurrence.

To eliminate this inconvenient method and its accompanying expense, continual and effective impact can be obtained by allowing rubber balls to bounce against the underside of the screen surface. Ball impact against a properly tensioned wire cloth causes a secondary vibration in the wires, which dislodges moist material. This method of eliminating blinding due to moisture is used by several vibrating screen manufacturers.

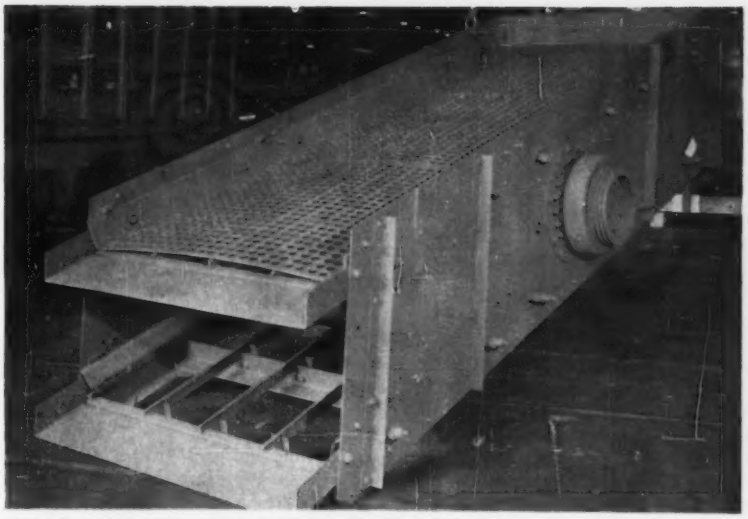
Using Screen Heaters

Heating the screen surface has become increasingly popular in the last several years. The heat created in the screen surface by an electrical current dries the particles clinging to the wire cloth. When the moisture in these particles is sufficiently reduced, they drop from the wires. Naturally, other moist material takes the place of the dried particles, but the continuous supply of heat keeps material from building up on the cloth.

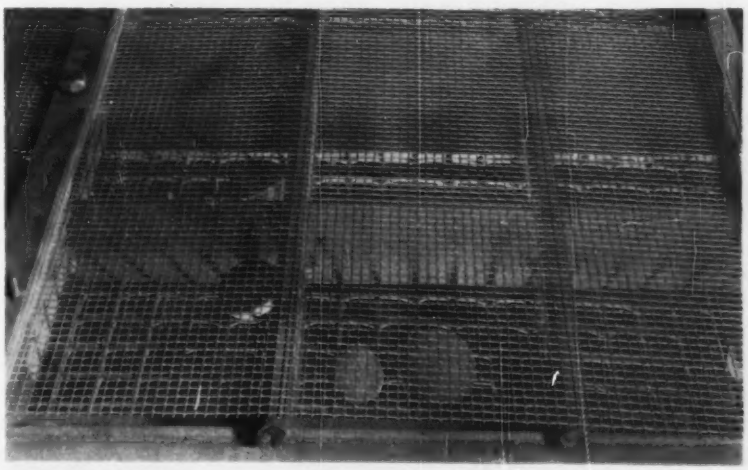
Heating the screen surface is accomplished by passing a low voltage electric current through the screen surface. Low voltage current, used to insure safety, is produced by single phase transformers having variable secondary voltages of approximately three to eight volts. The adjustable secondary voltage permits varying the heating to suit changing moisture in the material.

For larger screen cloth openings, which in turn mean larger wire diameters, both the continual impact method and the electrical heating method of eliminating blinding become ineffective.

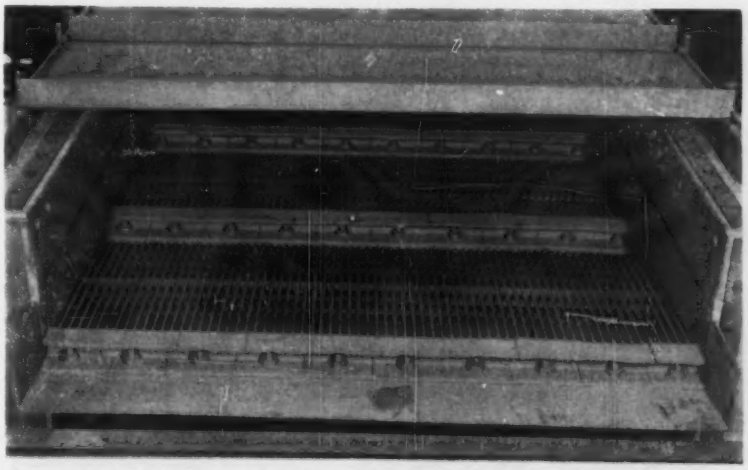
The mass of balls required to produce a secondary vibration in the wires would be unreasonably large; and, similarly, the decreased electrical resistance of larger diameter wires would necessitate larger and more expensive transformers in order to reach



FLAME DRYING can be used on large opening screens. Burners installed under the screen throw flame parallel to or at a slight angle to the underside of the screen.



RUBBER BALLS placed on a support member can be used to clean the screen. Balls jar screen from underneath, inducing secondary vibrations in the screen to clean.



CHANGING SCREEN openings from square to rectangular sometimes helps. Don't tamper with operating characteristics without first checking with the manufacturer.

Recommended Screen Throw, Speed and Slope

Screen opening, round or square (in.)	Throw (in.)	Speed (rpm)	Angle of operation (deg)	Direction of rotation
35 mesh to 1/8	1/16 to 1/4	1000–1750	22 1/2–30	Counterflow
1/8 to 2	5/16	900–1000	18–20	Flow
2 1/8 to 5	3/8	800–900	18–20	Flow
5 1/8 to 8	7/16	700–750	18–20	Flow
8 1/8 to 10	1/2	650–700	18–20	Flow

an adequate heating level. Such a situation calls for more drastic measures!

In place of electrically heating such a screen surface, flame heating has often been successful. This drying procedure calls for placing gas burners below the screen to throw a long flame parallel to or at a slight angle to the underside of the screen cloth. While results are good, hot combustion gases in an open flame so close to the screen's mechanism usually make it necessary to cool the mechanism.

Special screen surfaces can sometimes eliminate blinding of larger openings with sticky material. The long slotted openings used reduce the tendency for sticky material to plug the openings simply because they offer more open area and because, in the flow of material, there are fewer cross rods or wires on which sticky material tends to collect.

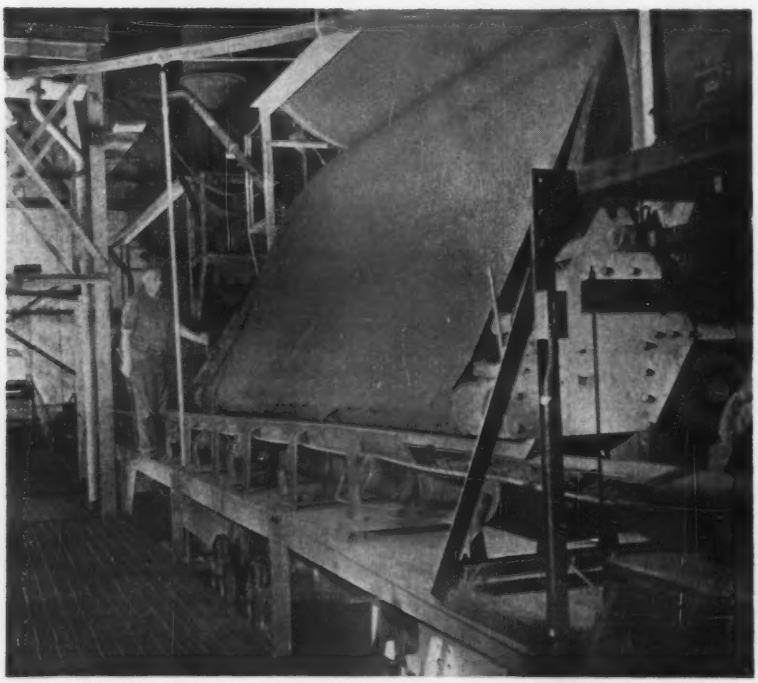
Slabby or slivery material can be a source of trouble whether it is screened in the bone dry state or wet. These particles plug the screen surface by wedging themselves into it so tightly that the vibration of the screen cannot throw them out.

Openings up to 3/8 in. can be kept clean by making use of continual impact on the cloth with rubber balls as previously described. For larger openings, perforated plate should usually be substituted for wire cloth. The wires forming the openings in a wire cloth are flexible to a degree. When a wedge-shaped piece enters the opening, it tends to spread the wires, but the wires in turn exert an increasing force on the particle due to the spring action of the wires. Since the bars between the holes in perforated plates are more rigid, this spring or wedging tendency is diminished.

Where exceptionally elongated pieces are encountered, they may get into the openings in a perforated plate, and, peculiarly enough, are not thrown out of the opening by the vibration of the screen even though they are not wedged into the opening. If occasional pieces of this kind are encountered, the situation may not always require much concern, since the action of the screen and other material passing over the particle will usually cause it to wear itself down and pass through the opening.

In the rare cases where large numbers of elongated pieces are hard or highly abrasive and, consequently, will not wear themselves down, measures must be taken to overcome the blindings and to avoid excessive wear on the screen surface.

More force is required to throw elongated pieces out of the screen surface openings than is required for cubical material. This additional force is obtained either by increasing the speed or the amplitude of vibration. Increasing the amplitude seems to be the most effective. However, before increasing either the speed or the amplitude, be sure to consult the screen supplier. His wide experience with similar problems will help you cure the difficulty quickly, with least expense.



STRING DISCHARGE rotary vacuum filter used by White Pine Copper Co. handles 20 to 25 tph of 80% minus 325-mesh copper flotation concentrate (50% moisture).

How White Pine Filters Fine, Slimy Copper Pulp

FROTH FLOTATION of ores which require fine grinding and the presence of surface active chemicals for efficient separation generally lead to slimes or slimy slurries that are slow and difficult to dewater.

Every pound of water that can be removed mechanically, instead of by evaporation prior to smelting, leads to large savings in fuel and greater furnace throughput. White Pine Copper Co., White Pine, Mich., in working low grade copper ores, successfully

solved this problem by the use of a large conventional thickener, followed by rotary vacuum drum filters.

The latter have demonstrated unusual capacity to dewater the slimes, reducing water content from 50% to 17% in a single pass, handling peak overloads without reduction in efficiency, without blinding, appreciable maintenance or downtime.

The filters, each rated at 18 tph, normally handle 80% minus 325 mesh at a rate of 20 tons and up to 25 tph, 24 hours a day, seven days a week.

White Pine Copper in 1952 opened a large low grade orebody near the old White Pine in Michigan's upper peninsula. The ore contains chalcocite and native copper as the chief copper minerals and runs 1.1 to 1.2% Cu with some 40 oz of recoverable silver per ton of copper. The balance is shale and siltstone.

The operation was developed to produce 12,500 tpd of ore on a 6-day schedule, with the mill grinding 10,000 tpd on a seven-day schedule from a plus 300-million ton proven orebody. It employs some of the largest ball mills and classifiers in the world.

Essentially, the ore is crushed in several steps, ground and carefully classified. Particle size and size distribution proved to be extremely critical with this ore: Separation of metal values from the gangue by froth flotation yields a concentrate containing 8 to 10% solids.

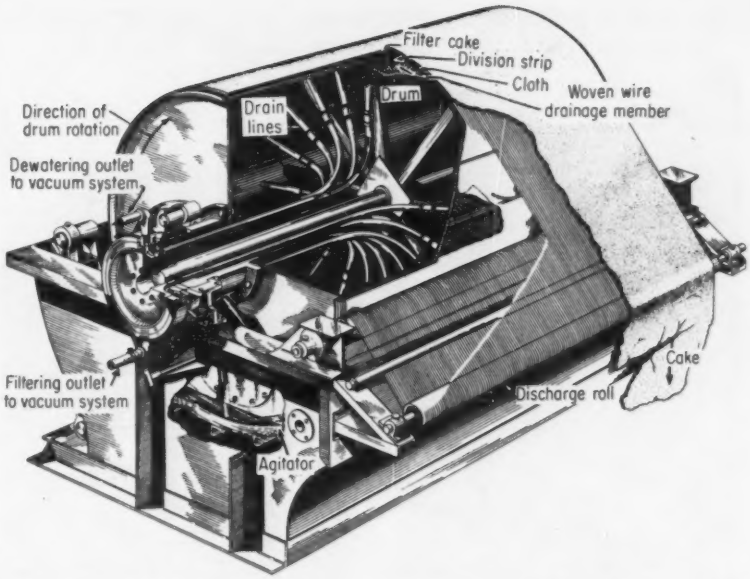
The first step of dewatering this material is via a 100-ft dia conventional thickener, the underflow from which approximates 50% solids, 80% minus 325 mesh, 30% copper, together with appreciable quantities of kaolin, feldspar, refractory slimes and silica. This produce constitutes the feed from the second stage of dewatering which is via one of two continuous vacuum drum filters, supplied by Filtration Engineers, Newark, N.J.

Difficult Problem

Anticipating that filtration of the slimy slurry concentrate would be difficult, a pilot-sized continuous, rotary vacuum filter was provided by Filtration Engineers in order to evaluate the many variables involved.

Dewatering to the lowest possible level was essential from a subsequent fuel consumption point of view. Complete elimination of solubles from the filter cake was found not to be essential, and a washing cycle on the filter could be eliminated. Initially, the pilot filter was equipped with a scraper discharge. This, however, led to cloth blinding and the blow-back required led to the return of appreciable quantities of filtrate to the filter cake and the consequent discharge of too wet a cake.

When the pilot filter was equipped with string discharge and with a compression blanket-roller assembly, a clean, readily discharged filter cake resulted, containing only 16 to 17% water. The compression assembly alone reduced the water content by 3%. Moreover, there was no cloth blinding.



STRINGS pick up and discharge the cake after dewatering the concentrate to 17% moisture. Only one filter is needed; the other serves as downtime standby.

One Does It All

On the basis of these studies, two filters were installed, one for operation and one for standby. This is in strong contrast to the 10 filters originally contemplated. One or the other of the two filters has been in continuous operation since October 1954. The service is unique considering the difficult slimes which are processed and the occasional peak overloads handled without appreciable increase in moisture content of the filter-cake discharge. With a 10.5 ft dia by 18 ft face, each filter has approximately 600 sq ft of cloth area. Normal filtering rate is about 60 lb per sq ft per hour. The filtering medium covering the drum is 4-oz Nylon supported by a coarse-mesh backing cloth, and discharge is effected cleanly by means of Nylon strings on ½-in. centers.

The drum revolves slowly—about once in two minutes—in a tank of slurry concentrate with a pH of about 11. This latter characteristic makes possible the use of mild steel as material of construction. An agitator in the tank of the filter oscillates back and forth under the drum, keeping the solids in suspension and the filter cake build-up uniform.

The surface of the drum is divided into shallow compartments which are connected by individual pipelines to an automatic rotating valve which serves to connect the vacuum system progressively to each compartment and thus suck out the filtrate and deposit the solids on the drum.

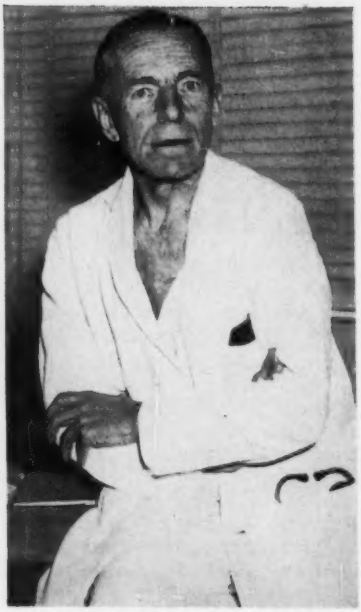
The cake, compressed and free of cracks, is lifted cleanly from the drum by a string discharge mechanism which consists of a series of individual Nylon strings tied to make them endless. As the filter rotates, the strings pass around the drum and down over a small-diameter discharge roll where the abrupt bend dislodges the cake from the strings. The strings then pass through an aligning comb and are guided back onto the filtering drum by means of the return roll.

The firm, pasty discharge from the filter is of proper consistency and low enough in water content to be mixed directly with smelting fluxes of limestone and pyrite and fed to a reverberatory furnace.

Maintenance on the filters since installation has been much below average for the mill as a whole. Filter cloth life is approximately six months. Compression belts last one year, and string replacement is no more than two spools per month.

There have been no mechanical parts of the filter that have had to be replaced since the filter was put into operation in 1954.

CHULEC GENERAL HOSPITAL at La Oroya is the hub of Cerro's medical program. Modern facilities for internal medicine, surgery and pathology are available.



DR. KURT HELLRIEGEL is chief surgeon and medical director in Peru.

Cerro de Pasco's Medical Division Charts Way to Better Health

SPEAKING AT THE DEDICATION of a new hospital, some 14,000 feet above sea level in the Peruvian Andes, a company medical director told his predominantly native audience:

"Our purpose here, as in our other hospitals at La Oroya, Yauricocha and elsewhere, is to provide modern facilities where employees and their families can obtain medical advice and help, *in time*. I emphasize the words 'in time,' for of what value is a hospital if a patient with advanced tuberculosis arrives asking for treatment as a last resort? Of what value is a hospital to a woman plagued with a cancerous growth so far advanced that it offers no possibility of effective treatment?

"This, my friends, is not the reason we build hospitals. Our purpose is to conserve your health and that of your family. If you cooperate in coming to us when you feel the first symptoms of disease, our efforts to achieve a good standard of recovery to health will meet with success, and our hospitals will become a source of confidence and family happiness."

The spokesman was Dr. Kurt Hellriegel, chief surgeon and medical director in Peru for Cerro de Pasco Corp., one of the world's leading producers of nonferrous metals, with principal operations in Peru and metal fabricating plants in the U. S. The facility being dedicated was the new 17-bed Goyllarisquizga Hospital located in the Andean mining community of that name.

From its founding in 1902, Cerro de Pasco has provided free medical care for all its workers and employees.* With the extension of the enterprise, the provision of medical services has grown proportionately.

Staff Mostly Peruvian

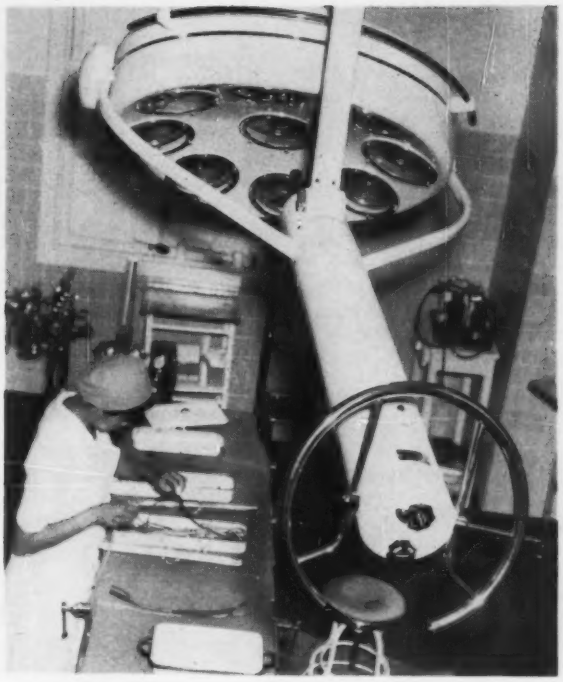
Today the medical division's professional staff of 161 physicians and surgeons, dentists, technicians, nurses and auxiliary medical personnel, with the assistance of some 180 orderlies, have responsibility for the care of some 20,000 workers and employees, as well as their families. Dependent children up to 18 years receive complete medical care. Other residents of the area—tradesmen, farmers, and others—may also avail themselves of the corporation's medical services, paying a nominal fee for the privilege.

Among the doctors employed by the medical division, all but two are Peruvians, as are the nurses and technicians.

Over the years the corporation's expenditures for medical services have run into many millions of dollars. Last year, for example, the total cost of such services rendered in Peru by Cerro de Pasco amounted to approximately $750,000. This expenditure was equivalent to about 17c for each dollar of consolidated net income, before depletion, earned by the corporation in 1957.

The area embraced by Cerro de Pasco's operating properties in Peru covers approximately 8,000 square miles, located astride the Andes in rugged mountainous terrain at altitudes ranging on the average from two to three miles above sea level. The whole of the mining belt is above 12,000 ft, with numerous jagged peaks, covered with glaciers and snowfields, rising to 20,000 ft and more. Within this setting the corporation engages in the mining, smelting and refining of copper, lead, zinc, silver, gold, bismuth and other metals.

*The distinction is purposeful. By Peruvian law there is a demarcation between empleados (salaried employees) and obreros (hourly wage earners).



LABORATORY TECHNICIANS (above) at work in Chulec hospital. Modern operating room facilities (right) also at Chulec.

Cerro de Pasco also produces its own power from hydroelectric plants located on the Yauli, Mantaro and Paucartambo Rivers. In addition, it owns and operates coal mines, holds large tracts of ranch land supporting some 200,000 sheep, and maintains numerous other ancillary facilities necessary to support both its principal endeavor and its many people. Such operations include retail stores, hotels, residential properties, schools, hospitals and first aid stations, as well as a 160-mile standard gage railroad fully equipped with rolling stock.

A Three-Center Plan

To provide complete health services throughout this vast area, the corporation has evolved what is known as a "3-center medical plan." Aim of the plan is to make hospital facilities easily accessible to each mining and plant community. Six small modern hospitals serve the Andean communities of Morococha, Casapalca, Goyllarisquizga, Mahr Tunnel, San Cristobal and Pachacayo. Three main centers, strategically located at Cerro de Pasco, La Oroya and Yauricocha, provide full treatment facilities in the northern, central and southern regions of Cerro de Pasco's 200-mile-long properties.

The main health center, Chulec General Hospital at La Oroya, center of the corporation's smelting and refining operations, is equipped with the most modern facilities available for internal medicine, general surgery, including thoracic surgery and urology, traumatology, obstetrics-gynecology, pediatrics, and ophthalmology-otorhinolaryngology. In addition, a specially designed laboratory at Chulec handles all pathological work for the medical division.

Chulec has earned nationwide recognition in Peru as one of the foremost training hospitals in the country. It regularly receives interns from the Facultad de Medicina de San Fernando of San Marcos University, the oldest institution of higher learning in the Western Hemisphere.

Hospital Use Is Growing

The corporation's combined hospital facilities now total 376 beds, and the rate at which use of the hospitals has been growing indicates a need for continued expansion. During the seven-year period, 1951 through 1957, the number of patient days increased from 30,700 to 73,175.

This growing acceptance of hospital care and available medical services has come about only through persistent educational efforts on the part of Cerro de Pasco's medical division, with the active cooperation of the divisions of safety and industrial hygiene, and industrial relations.

To appreciate the problems confronting the corporation's medical practitioners through the years, one must bear in mind not only the vast size and remoteness of the area but the fact that Cerro de Pasco's development has meant superimposing a modern, highly complex industrial system upon a simple, almost feudal agricultural economy. Chief among the obstacles which had to be overcome, and which in lesser degree remain to this day, was the prevalence among the native population of ignorance, fear and superstition in matters relating to disease and its prevention.

"One Dead Baby, One More Angel"

For example, the death rate in children up to 14 years (chiefly infant mortality), which a few years ago amounted to more than 50%, has dropped within the past three years to approximately 8% as a result of the concerted effort of the medical division's young pediatric service. According to Dr. Hellriegel, however, "it is sad to relate that many babies and children in extremis are still brought to the doctor. Ignorance, carelessness, and the strange belief expressed in the phrase, 'one dead baby, one more angel,' are the reasons underlying a still disproportionately high mortality rate."

The situation is steadily improving, Dr. Hellriegel notes, as the resident population, in increasing number, turns its back upon the "curandero," or quack doctor, and avails itself of the professional medical services provided by the corporation.

In 1951, for example, no more than 20 native women were admitted to the maternity wing of Chulec

PEDIATRICS SUPERVISOR, Mrs. Teresa de Medina, assists internist F. Kruger during medical examination of a not altogether happy child at Chulec hospital.

General Hospital. Now the majority come for prenatal care and have their babies in the hospital. Thus, in 1957, no fewer than 501 were admitted for delivery. The result has been the saving of many otherwise fatal cases and the avoidance of puerperal infections.

Increased acceptance of and dependence upon the modern practitioner and his scientific methods stem from the fact, as Dr. Hellriegel explains, that "we could prove that modern medicine produces better results, even at high altitudes, provided the doctor is acquainted with the particular problems caused by the existing hypoxic conditions. Our internist, Dr. Einar A. Lundberg, and one of my predecessors as chief surgeon, Dr. Knute E. Berger, were the first to recognize the possibility of treating people here at these high Andean altitudes with fully as much safety as at sea level. Dr. Berger proved that even major surgery can be performed here safely and effectively. To these two men we owe a debt of gratitude for demonstrating that in these lofty areas near the 'roof of the world,' we can treat any type of disease and perform any type of major surgery."

Life Expectancy Increasing

Life expectancy in the area has been increasing and now stands at 53 years for men and 58 years for women (as contrasted with 67.4 and 73.6 years for white males and females, respectively, in the United States).

The incidence of diseases encountered in Cerro de Pasco's Andean population is quite different from that in other countries. For example, statistics of surgical ailments, which include only diseases of the abdomen, pelvis and retroperitoneum encountered in 1957, indicate that operations were performed (to mention only the more important ones) in 26.3% for disease of the gall bladder and bile ducts, in 5.3% for diseases in the liver (mostly hydatid cysts), in 7.7% for disorders of the stomach and duodenum, in 1.7% for disorders of the small intestines, in only 12.4% for appendicitis, in 5.3% for pathological conditions of the colon and rectum (chiefly for volvulus of the sigmoid colon and only two for a malignant tumor of the colon and rectum), in 36.0% for alterations of the female reproductive organs, in 5.3% for diseases of the bladder and prostate (among which there was no case of cancer).

"From these data," Dr. Hellriegel points out, "it is clear that the incidence of appendicitis is surprisingly low; why this is so remains a mystery. Another amazing fact of our experience is the extremely rare incidence of diphtheria, not only in the Andes but elsewhere in Peru. We are unable to account for the fact that we have not seen a single case in La Oroya within the last seven years."

Low Cancer Incidence

Dr. Hellriegel described as "remarkable" the fact that in 1957 no surgery was done either for cancerous or benign tumors of the kidneys or bladder, although very thorough and complete examinations were performed in all patients with hematuria.

"It is also noteworthy," he continued, "that we have seen to date no more than six cases of lung cancer, although X-rays are taken of every mine worker and salaried employee, and routinely also of every hospital admission. None of these six cases had been exposed to arsenic fumes. Gasoline fumes do not exist in significant concentration here. Perhaps significantly, the consumption of tobacco is very limited among our population. Another interesting observation is that cancer of the skin is practically unknown in this region with its considerable solar irradiation. Within the past seven years, only three cases have been encountered."

Coronaries Virtually Nil

Coronary artery disease is practically unknown among the native population. The same also is true of arteriosclerosis, thrombosis and embolism. Why this should be so is something of a mystery. It may be that future studies planned by the medical division will shed some light on what constitutes a presently conspicuous medical problem in our own country.

The use of coca is seldom observed in the vicinity of La Oroya but is more commonly in evidence elsewhere in the Peruvian sierra. The crushed leaves mixed with lime and rolled into a small ball contain only a small amount of cocaine. The drug is therefore absorbed through the mucosa of the mouth in a very low concentration. Use of the drug produces a certain exhilarating effect enabling the individual to do his work despite inadequate nourishment. The coca addict, because of the hunger-suppressing effect of the drug, in time becomes a victim of malnutrition and in many instances contracts tuberculosis.

In 1951 the records of the corporation's pre-employment examination clinic at La Orova reveal that of 3,948 applicants for work, 124 were rejected for tuberculosis, a rejection rate of 3.1%. In 1957, of 673 applicants, only 4, equivalent to .006%, were rejected for tuberculosis. There

is reason to believe, therefore, that treatment of tuberculosis during the past few years has contributed to reducing the incidence of new cases. Recovery from tuberculosis is more rapid in the high altitude of the Andes than along the Peruvian seacoast, partly due to the dry atmosphere prevailing in the mountains and partly to the shallow breathing characteristic of the rarified altitudes, which avoids overtaxing the convalescent tissues.

Positive serological reactions for syphilis are indicated for 8% of the resident population, despite the fact that, as Dr. Hellriegel observes, "practically never are secondary or tertiary lesions encountered. We assume that in the course of centuries a considerable natural immunity has developed within the native population. Promiscuity and lack of knowledge of the disease undoubtedly account for the high incidence of this illness."

10,000 Children Treated

Most of the children who are treated at the corporation's hospitals are found to be anemic, with consequent lowered resistance to disease. In the course of undergoing treatment for infection, therefore, they also must be treated for malnutrition. The primary cause of such anemia is an oversupply of sugar combined with inadequate amounts of other food requirements. A common practice among mothers of the native population, after weaning babies, is to stir up a baby-food consisting of from one to two teaspoonful of sugar in a cup of milk, thus supplying all the calories the child needs but only infinitesimal amounts of other basic nutriments. Since mothers of the Andean sierra have only a meager knowledge of essential dietary requirements, they are more likely to feed their offspring a diet of candy than anything else, with consequent tooth decay, debilitation and susceptibility to disease.

That children generally fall easy prey to Andean illnesses is indicated by the health records for 1957. In that year, 10,115 of 12,500 children in La Oroya were treated at Chulec General Hospital. The incidence of disease in children up to 14 years thus exceeded 81%. Bronchitis, bronchopneumonia and malnutrition are extremely frequent among children in this age group, caused in part by extreme diurnal variations of climate and partly as a consequence of poor clothing and unnecessary exposure to the weather.

Dr. Hellriegel points to the significant decline in child mortality, from over 50% a few years ago to approximately 8% within the past three years, as evidence of a decided improvement in the care and treatment of childhood diseases. Says Dr. Hellriegel, "as recently as several years ago, only a very few babies and children were brought into our clinics, although experienced doctors and adequate facilities were easily available. It is true that during that time there was still a great tendency among our native population to prefer the quack. No wonder that the mortality was extremely high from such contagious diseases as typhoid fever, epidemic typhus, and tuberculosis. Malnutrition of varying degree in children represented a significant cause of death. Today, for example, when we carefully analyze the history of an older woman, we find that she may have had 11 normal deliveries. But, in the next breath, we discover that only four of these 11 children, apparently healthy at birth, survived infancy and are still alive."

Prevention Is Stressed

Parenthetically, there is no doubt that natural selection operated through the years to create exceptionally strong individuals whose resistance to infectious diseases is surprising and whose resistance to alterations resulting from severe disease or trauma is nothing short of remarkable. According to Dr. Hellriegel, "it is an amazing experience to view an individual patient's recovery from a generalized peritonitis of two or three days duration with a facility unmatched, to my knowledge, on our Peruvian coast, in the United States, or in Europe."

The answer to malnutrition in children is the same answer that thus far has spelled success for other facets of Cerro de Pasco's medical care program, and will continue to do so in years to come—a combination of informed and dedicated practitioners, modern hospitals, and a population educated to the opportunities for improved health represented by such a program. Mothers must be taught to discontinue the use of sugar as a substitute for a balanced diet, and instead to feed their children such staples as whole milk, eggs, vegetables, meat and fruit.

Further, parents must be convinced of the importance of preventive measures. In 1957, some 2,184 vaccinations were performed, including whooping cough 482, anti-typhoid 324, smallpox 428, BCG 414, and revaccinations 326. Impressive as this total is in contrast to the experience of a few short years ago, it is nevertheless only a beginning. Adds Dr. Hellriegel, "much patience has been and will be required to get the maximum number of children vaccinated."

Also in the field of child care, it is pertinent to mention that a major step in preventive medicine was initiated in 1950 in respect to turberculosis in children. In the period 1950-1956, 12,617 school children were examined. In the interest of safeguarding the health of the community as a whole, all children were examined regardless of whether or not their fathers were employed by the corporation. A measure of success of this program is to be found in the statistical results which show that in 1950, 2,088 students were examined, of whom 85, or 4.07%, were found to be tubercular. In 1956, of 2,528 examinations, 21 cases or 0.83%, were so reported.

Andean Biological Institute

In this, the threshold stage of the space age, man is becoming indoctrinated to the possibilities of travel in regions far removed from his "native" atmosphere. Scientific experiments, some of an extremely sensational nature and others on a more routine basis, are continuously being conducted with the purpose of determining the ability of a human being to exist in space. Rather unheralded and long before the "sputnik era," the "Facultad de Medicina de San Fernando of San Marcos University co-sponsored with the United States Air Force the Andean Biological Institute at Morococha, Peru. The purpose of the Institute is to study the effects of high altitudes on man, and in this connection the corporation's medical personnel facilities and records have made an important contribution.

Which brings us again to the remarks of Dr. Hellriegel on the occasion of the recent dedication of the new Goyllarisquizga Hospital: "increasingly our people are recognizing that prevention of disease is the key to good health. And it is a source of immense encouragement that our population, in ever greater numbers, is turning away from antiquated ideas and accepting the help that modern science can offer in our hospitals."

Note to Mine Managers

Copies of this article outlining an advanced preventive medical policy, and a modern hospital and medical program for mine properties will be mailed for distribution to your medical staff. Send request to *E&MJ*, 330 West 42 St., New York, N.Y.

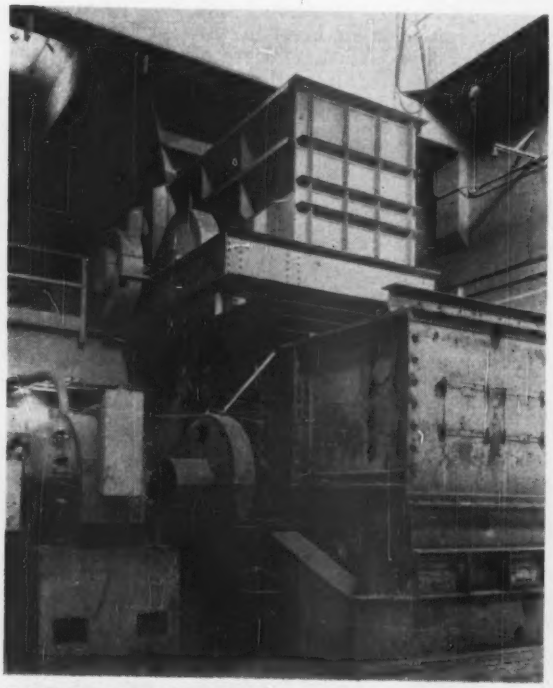
ORE FROM THE PIT goes directly to the crusher without benefit of any drying. Moisture content is generally in the range of 22%, but during the wet season the mill men describe some of the product entering their hoppers as "hit-and-splash."

Hammer Mills Handle Sticky Bauxite

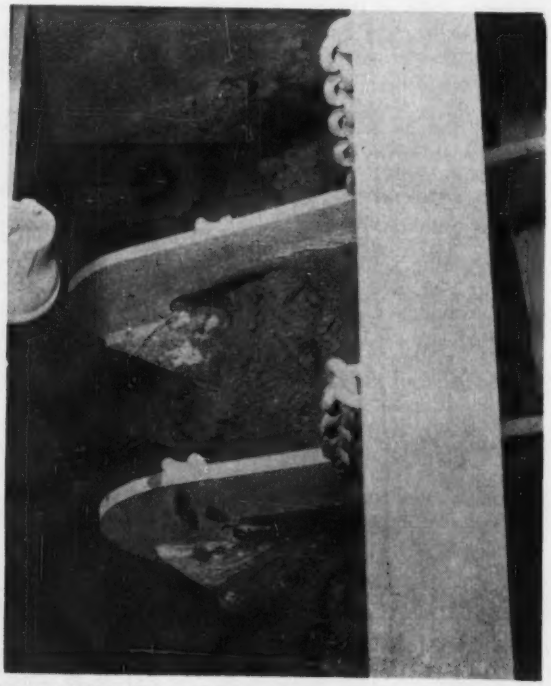
OVERCOMING THE PROBLEM of sticky, run-of-mine bauxite ore was one of the major difficulties at Aluminum Company of America's Bauxite, Ark. works. The ore is extremely abrasive, with a high moisture content (22%) and challenges crushing and handling material in the extreme.

Solution to the problem of handling 800 tons per hour of the material at the crusher came with installation of two moving breaker plate hammer mills. And Alcoa has found maintenance and operating cost considerably lower than in previous methods. Four men are required to operate the twin-mill facility.

At Bauxite, mining is simultaneous

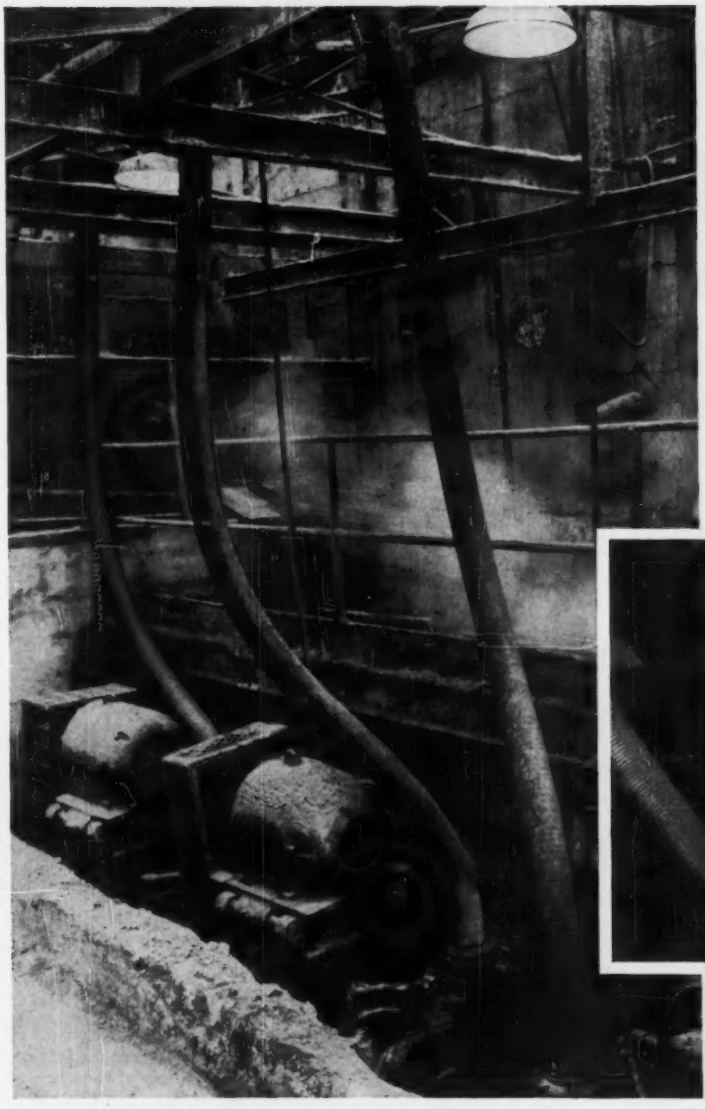


HAMMER MILLS handle 800 tons per hour with six sets of hammers. Feed is automatically governed against overload.



MILL PRODUCT FLOW would be chunky and affect belt wear and weighing. Plows and chains break product at the belt.

US RUBBER PILOT PIPE



Abrasion in piping?

Here's how a big uranium mill solved it with "U.S." flexible rubber pipe

• Four 8" U. S. Pilot Pipes carry fine screened ore from secondary crusher storage bins. Four more pipes feed too-coarsely crushed aggregate onto a conveyor belt and back into the crusher. On both jobs, Pilot Pipe has lasted over 4 years.

• In this severe service, quenched calcined ore pulp —50% solid—is pumped through these lengths of U. S. Pilot Pipe, from the roaster calcine pumps.

Where to get flexible piping that can stand up to severe abrasion without being chewed up?

Union Carbide's Uravan mill found the answer in U. S. Pilot® Pipe and Pinch Valves. In addition to the operations pictured above, these products handle the slurry on the 9 separate pumping stations of the counter-current decantation wash circuit, are used on the 2 booster stations between leach and tailings disposal plants and between the primary acid leach and roaster.

This pipe is specially built to handle abrasive materials, such as calcined ore, *and corrosive* materials, such as solutions containing sulfuric and hydrochloric acids. It is flexible, easy to install and won't build up. Its service life is longer than that of metal pipe.

• • •

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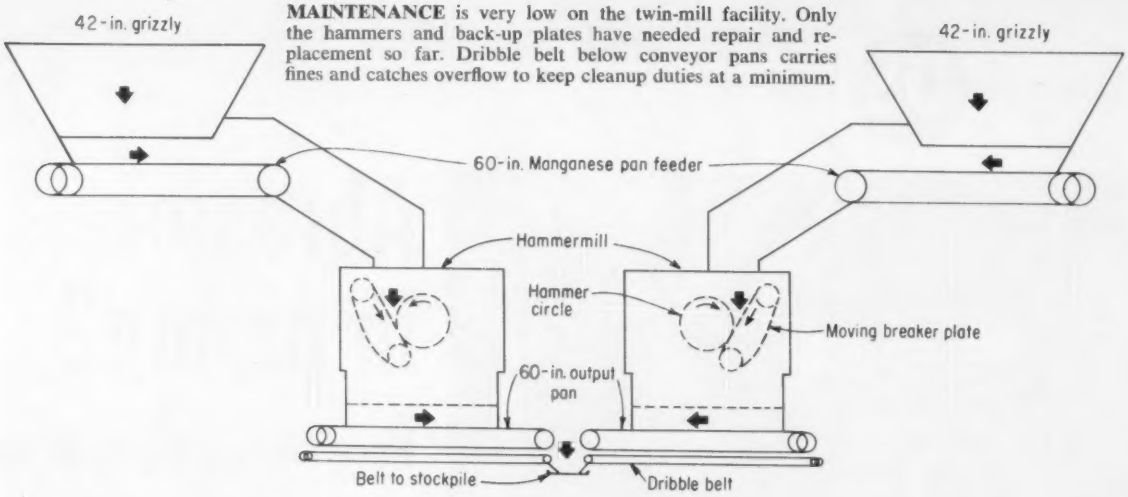

MAINTENANCE is very low on the twin-mill facility. Only the hammers and back-up plates have needed repair and replacement so far. Dribble belt below conveyor pans carries fines and catches overflow to keep cleanup duties at a minimum.

in several different open pits. The multiple mining permits blending of the raw material to conserve the high grade deposits. Blending controls silica content at 13- to 14% although the individual deposits may contain a much higher percent.

Moisture content of raw bauxite varies from 12- to 22%, depending upon the season, physical characteristics and mining conditions. During the wet season, from December through May, the material has been known to "hit-and-splash" as it falls into the mill hoppers.

Moisture is the main crushing problem. Always wet, bauxite tends to pack and build up in crushing equipment, clogging flow. However, special attention to the design of the swinging hammers and the moving breaker plate in the Alcoa mills has substantially eliminated this problem. In five years of high capacity operation the mills reportedly have rarely been plugged by the plastic material.

Run-of-the-mine material is loaded at the pits by 2½-yd shovels into 25-yd end-dump Euclid trucks which carry it directly to the mill. The trucks dump directly onto ground level grizzlies. Because the wet material has a tendency to stick in the dump beds, each truck is equipped with a kicker-plate to knock it loose. In addition, each truck spotter—two of the mill's four operating personnel—has a compressed air lance with which he can blast loose any obstinately sticky material which the kicker plate fails to dislodge.

Beneath each of the two 42-in. grizzlies a 60-in. moving manganese pan feeder conveys the material to one of the two 60x56-in. hammer mill hoppers. The mill design is the key to successful, efficient, uninterrupted bauxite crushing.

The two mills are HMIR-06 Bulldog Hammermills (above) manufactured by Hammermills, Inc., Cedar Rapids, Iowa, a subsidiary of Pettibone Mulliken Corp. Each has three sets of five 400-lb hammers operating at 585 rpm on a 60-in.diameter, 60-in. wide hammer circle. The hammers are powered by a 400-hp General Electric rotor-wound, direct-connected motor. In addition, the moving breaker plate is powered by a separate 15-hp motor. Design capacity of each mill is 400 tons per hour; however, capacities up to 550 tons per hour have been attained.

Feed from the hopper to the mills is governed automatically to prevent overload. The variable speed feeder drive is normally set at 100% by a manual potentiometer adjustment. If the mills become overloaded, the current of the direct-connected hammer-drive motor will jump from a normal 500 amp to as much as 800 amp. Any overload current continuing for more than 20 seconds operates a time-delay current relay to stop the feed drive until the mill has caught up as indicated by return of the drive motor current to normal. Only one man is needed to operate both hammer mills.

The hammer mills' product, minus 1-in. crushed bauxite, when ready for fine grinding on rod mills, is deposited on 60x60-in. conveyor pans. Wet and plastic, the product fills to a 24-in. depth on the pans. To prevent uneven distribution on the stockpile conveyor system, which would be hard on both the conveyor and the output weightometer, the cohesive material is broken up as it leaves the pan conveyor.

Two stationary plows mounted above the mill product conveyors shred the plastic material into three longitudinal strips just before it drops off the pans onto the stockpile conveyor. As it drops 8 ft to the stockpile conveyor, the cascading material is further broken up by a set of pendant chains through which it must pass.

Hammer maintenance is a basic factor in successful hammer mill operation. The impact surfaces of the swinging hammers wear. If allowed to wear too much the hammers drag, the mill tends to choke up, and power costs climb. The fifteen 400-lb hammers in each mill are of manganese steel and actually harden in service. The hammer impact surfaces are allowed to wear from ⅜-to ½-in. and then the hammers are turned to present their second impact surface. When the second surface has worn a like amount, the hammers are removed and both surfaces are rebuilt.

One set of spare hammers for each mill permits continuous mill operation. Average life between rebuilding for one set of hammers during the 5½ years of the plant's operation has been 166,500 tons or about five to six months of normal operation. Record tonnage to date for one set of hammers before resurfacing is 252,241 tons.

The only other regular maintenance items in the operation of the mills is the replacement of the back-up plate which absorbs the impact of the moving breaker plate. Sixty inches wide, 11-ft long and made of 1½-in. abrasion resistant steel, this plate is constantly abraded by fine bauxite which filters through and builds up under the breaker plate. Back-up plates are replaced every three years.

Other maintenance is nil. Despite the heavy service—besides carrying the heavy hammer rotor and its three tons of swinging hammers they also support two 6,000-lb flywheels—none of the hammer mill bearings has failed in over 5½ years of operation. Duplexed to sustain thrust loading, the tapered roller bearings are sealed to prevent fouling by dust and are lubricated with a circulating oil feed.

JENKINS FIG. 106-A BRONZE GLOBE 150 LBS. STEAM . . . 300 LBS. O.W.G.

in Disc Equipped Bronze Valves

LOOK at that Wheel — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK at the Index Plate — Has Fig. No. etched in green background. Held by wheel nut which is secured by rolled-over spindle end.

LOOK at that Spindle — Made of high tensile bronze. See how much heavier it is . . . how many more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK at the Packing Nut and Gland—Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK at that Packing Box — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK at that Bonnet — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK at the Disc Holder — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK at the Disc — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and **made by Jenkins**, the only maker of both valves and discs.

LOOK at that Body — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK at this . . . for Throttling

—Just replace the standard disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

THE FIRST renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

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VALVES

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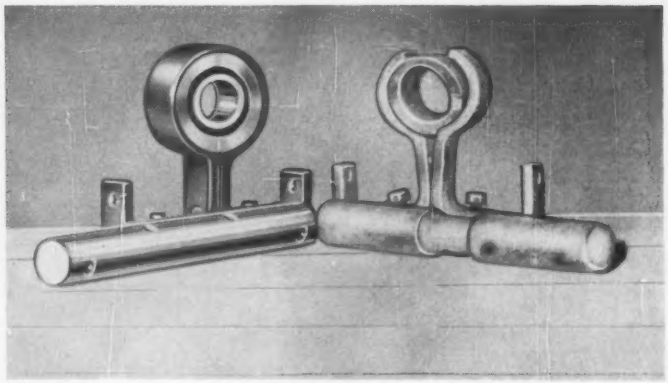
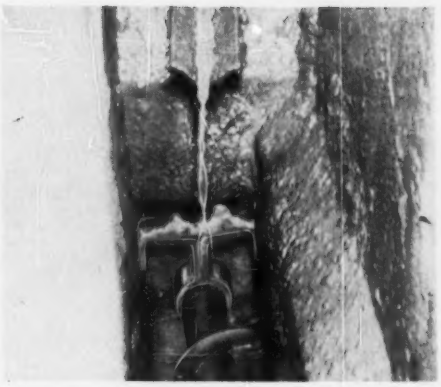
OPERATING IDEAS





How Sealed Ball Bearings Cut Costly Screw Conveyor Downtime

CAST IRON BEARINGS on a screw conveyor handling tungsten-scheelite-garnet slurries at Wah Chang Mining Corp.'s Tempiute mine had to be replaced every two to three weeks, costing the company $5 per minute during the averaged downtime of 1½ hours per failure. During one year, bearing failure caused 67 shutdowns and cost the company a total of $31,025.70.

Fafnir Tri-ply seal ball bearings (Fafnir Bearing Co., New Britain, Conn.) were introduced on a trial basis. During a full year of operation, only three shutdowns were required and costs were cut to $1,503.90.

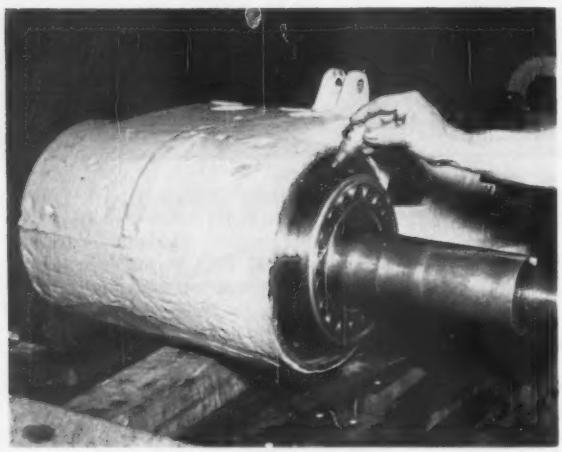
Formerly, the need for immediate replacement of worn cast iron bearings made planned replacement impossible. If not replaced immediately, they wore out so fast that the screw conveyor dropped to the trough bottom, resulting in ruined screw and trough. By using the ball bearings, Wah Chang can make planned replacements.

According to Fafnir, the advantages of its sealed ball bearings include: (1) self-alignment, free-running action; (2) prelubrication for life; (3) balanced design—extra wide for extra support on the shaft; and (4) stainless steel outer ring that protects multiple seals.

The company also reports that under field tests, the bearings and seals performed satisfactorily and without failure for 3,500 hours while completely submerged in dirt, 2,500 hours in cement box tests, and 250 hours in a combination of sand and water.

Bearing Costs—Tempiute Mine

	Cast Iron (67 failures, 67 shutdowns)	Ball (15 failures 3 shutdowns)
Downtime	$30,150.00	$1,350.00
Labor (at $3 per hr)	300.00	13.50
Bearings	575.70	140.40
Total	$31,025.70	$1,503.90



Plastic Speeds Crusher Repair

A 9-IN. spherical roller bearing was replaced in the jaw of a rock crusher in less than an hour instead of the three to four days formerly required, and gave the Acme Road Machinery Co., Frankfort, N. Y., a $155 savings. The company did this by mounting the bearing with a slip fit and retaining it with Loctite sealant instead of the interference press fit.

When this bearing was assembled with a press fit, it was necessary to remove ¼-in. from the housing I.D. by a boring operation, then deposit a ⅜-in. thickness of weld metal on the exposed surface, and finally, rebore the housing to provide a .0015-in. interference fit between the bearing and the housing. It then took two men several hours to install the bearing.

Now, using Loctite sealant (a thin liquid plastic made by American Sealants Co., Hartford, Conn.), the job is done in less than one hour. Acme rag-wipes the bearing O.D. and the housing I.D., roughens the mating parts with emery paper, applies Loctite to both surfaces, and assembles the bearing with a light push fit (clearances are approximately .003-in.).

How Streamlining the Mine Shaft Cuts Ventilation Costs

STREAMLINING INTERNAL STRUCTURES of mine shafts can reduce resistance to air flow by as much as 60%, according to scientists conducting model studies in the National Mechanical Research Institute, Pretoria, South Africa.

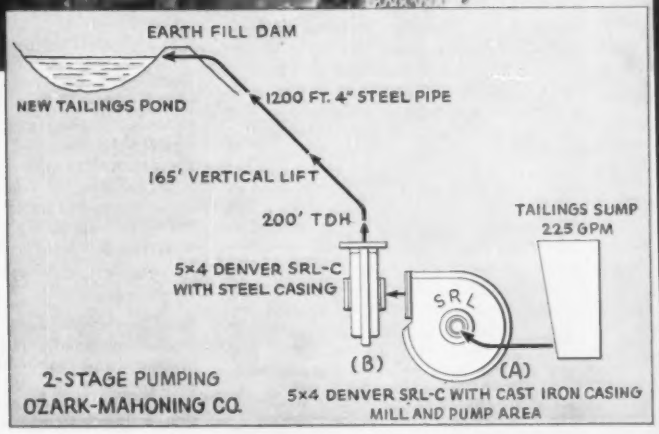
The wind tunnel was designed by the Council for Scientific and Industrial Research to serve in mine ventilation studies. The working section of the model has a 78-in. diameter and an effective length of 70 ft. A 100-hp variable speed dc motor with an electronic control unit is used to drive the fan which was designed for the experiment by Aerflo (Pty.) Ltd. The drive is sufficient to give air speeds up to 60 fps in the tunnel when unstreamlined structures of conventional design are tested.

The question of ventilation is particularly important in the Union's deep gold mines where underground temperatures are so high that even an hour's stoppage of air flow may have far-reaching results.

Over the years, it has been found that a large proportion of the horsepower needed to send air to the mine is lost in the shaft structure. Therefore, more powerful and expensive motors have to be used than would appear necessary.

Tailings given 1200 ft. Up-Hill Lift with

DENVER SRL·C PUMPS



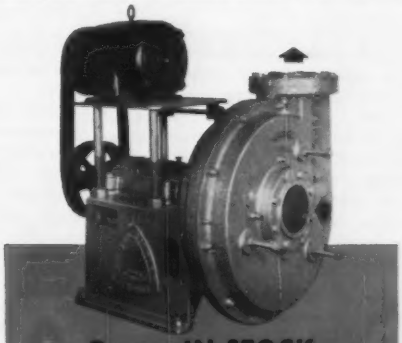
Only available site for new tailings pond for the Jamestown, Colorado, fluorspar mill of the Ozark-Mahoning Co., was located 1200' upstream. Vertical lift to new pond was 165'. Pulp consists of 7% solids at 60% — 325 mesh, 100% — 100 mesh. Disposal rate, 225 gpm.

Pump A draws from tailings sump at mill and, to gain lift and capacity, discharges directly into intake of Pump B. Tailings leave Pump B at a total dynamic head of 200' and proceed through 1200' of 4" steel pipe to new pond site.

Dependability and low maintenance are features the personnel at Ozark-Mahoning appreciate most with these DENVER SRL Pumps.

If you have an abrasive or corrosive pumping problem, no matter how simple or unusual, we invite you to let DECO engineers prepare a detailed recommendation on the correct size and type of pump to fit your requirements.

Sizes to 3000 gpm.



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WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Mining

Design for a ladder device which is assembled and extended in connection with the progress of a raise being driven in ore or rock, and which may be disassembled and taken down and used for driving further raises. The extended sections of the ladder form a shelter for equipment used at the working face of the raise and for conduits carried along the ladder to the face. B. E. Anderson, assigned to Atlas Copco Aktiebolag. No. 2,855,188.

Metal and Mineral Processing

Apparatus for removing sludge from clarifiers and thickeners, for example flue dust from gas washers connected with blast furnaces treating iron ores. R. Nebolsine and A. D. Henderson, assigned to Hydrotechnic Corp. No. 2,854,146.

Method for preventing erosion of finely divided mineral materials by wind and rain during open storage and transportation. The mineral mass is surface coated with a thin layer of an elastomer, such as natural rubber latex or a suitable butadiene-styrene emulsion. R. B. Booth and J. A. Melchore, assigned to American Cyanamid Co. No. 2,854,347.

Fluidized bed roasting for recovery of lead, zinc and cadmium from zinc sulphide concentrates. The roasting may be advantageously accomplished by substituting fuel gas for the solid fuel and using an excess of air to maintain non-oxidizing conditions in the upper portion of the fluid column wherein volatilization of non-zinciferous sulphides can take place. H. M. Cyr and T. F. Steele, assigned to New Jersey Zinc Co. Nos. 2,855,287-8.

Continuous process for direct reduction of oxide ores, especially oxides of iron, nickel, and copper, to the sponge metal state. Ore is pulverized, pelletized, roasted in air, and then burned along with a finely divided reducing agent comprising limestone and carbon. Sponge metal is recovered in pellet form, and the residue is suitable for calcining to produce hydraulic cement. H. Freeman, assigned to Freeman Corp. No. 2,855,290.

Design for an ore classifying apparatus for separating magnetic components of an ore pulp from non-magnetic components, and for desliming and dewatering the resulting fractions. The apparatus provides an integral magnetic separator and a mechanical classifying unit. Applications cited include separation of magnetite, roasted hematite, limonite and siderite from gangue, and franklinite from zincite. G. M. Meisel, R. Q. Gribble and D. J. Drinkwater, assigned to Colorado Iron Works Co. No. 2,856,-070.

Method for charging a fluidizing medium into a fluidized bed reactor used for chlorinating ilmenite ore. The gas, such as chlorine, is charged into the reactor through a vertical inlet conduit provided with a serpentine helical passage. W. E. Dunn Jr., assigned to E. I. du Pont de Nemours & Co. No. 2,856,264.

Mr. North is patent consultant, Washington, D.C.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Improved apparatus for reducing iron ore to produce iron powder which can be pressed into shapes or mixed with a carbonaceous binder and briquetted to make a product suitable for smelting. D. F. Dickey, assigned to Electrolyser Corp., Ltd. No. 2,857,155.

Method for reducing the loss of one or more metals in reverberatory furnace slags, for example, in the smelting of nickel and copper sulphide ores. J. N. Anderson, assigned to Noranda Mines, Ltd. No. 2,857,263.

Method for producing titanium from ilmenite, whereby the ore is first converted to dry alkali chlorotitanates which are then reduced to metallic titanium using an alkali metal reducing agent. F. V. Schossberger, assigned to Illinois Institute of Technology. Nos. 2,857,264-5.

Process for recovering a high-grade uranium concentrate from very low-grade ores or ore residues. An ore solution containing large amounts of iron and aluminum hydroxides and hydrated silica is diluted with water and subjected to multiple leachings with aqueous solutions of sodium carbonate of pH of at least 9. D. Kaugman and C. S. Abrams, assigned to U.S. AEC. No. 2,830,871.

These Patents—Seventeen Years Old—Have Now Expired

Recovering zinc from metallurgical by-products, in particular from zinc fumes produced during smelting of secondary non-ferrous metals. Water is added to the powdery material to form coarse particles, which are roasted to burn away organic matter and volatilize the chlorine. The roasted product is extracted with H_2SO_4. W. Seguine and J. Zweyer, Jr., assigned to Glidden Co. No. 2,264,-337.

Smelting $PbSO_4$-SnO_2 residues contaminated by small quantities of copper, arsenic, and antimony to recover a lead-tin alloy suitable for use in solder, metal type, etc. W. Seguine and F. N. Hillis, assigned to Glidden Co. No. 2,264,338.

In processing iron-tin ores, the iron and tin values are reduced to the metallic state in the presence of alumina, while avoiding melting of the iron, so that a large part of the tin is trapped in the alumina. The materials are then melted with added silicon, and the alumina slagged to release tin. The three products are: tin; ferrosilicon; and slag. L. C. Sturbelle, assigned to Hooker Electrochemical Co. No. 2,265,219.

Method of roasting metallic oxide ores to metal in a shaft furnace wherein the ore slides downwardly along zigzag chutes countercurrent to a rising flow of hot reducing gas. T. Nagel. No. 2,265,812.

This series of patents describes in detail methods for treating high-iron manganese ores to obtain the metal or ferro manganese. P. H. Royster. Nos. 2,265,-863-6.

In the production of ferromanganese and other manganese alloys from ore containing phosphorus, ore is smelted in a blast furnace with an acid slag yield, whereby almost all of the phosphorus is taken up in the pig iron product and the slag contains the manganese. H. Hahl, assigned to P. H. Royster. No. 2,265,902.

Hydrometallurgical process for treating manganese silicate ores. G. C. Westby. No. 2,266,137.

Process for extracting gold micelle from sedimentary or argillaceous rocks. Ore is ground and the contained gold dispersed in a colloid state. Gangue is filtered off and the gold recovered from the filtrate by coagulation or dissolution. J. J. Bonesteel. No. 2,266,155.

Method of separating and recovering tailings mercury from an amalgamation apparatus. B. W. Ramsay, assigned to Pressure Amalgamation, Inc., No. 2,266,-475.

Manufacture of high-grade malleable iron and steel directly from ore. A mixture of iron ore, limestone, charcoal and bauxite is charged to a rotary kiln. Alumina cement is produced as a by-product. S. Ruzicka. No. 2,266,816.

Process for extracting alumina from clay with acid. The clay is granulated before being calcined K. Büche and H. Ginsberg, assigned to Th. Goldschmidt Corp. No. 2,267,490.

Thickener for and method of concentrating or thickening slimes consisting of ore and gangue fines. H. F. Adams. No. 2,267,516.

In the purification of zinc sulphate solutions, the metal is precipitated by adding iron powder. M. Magnaghi. No. 2,267,659.

Improved process for smelting zinc ores and for recovering and purifying zinc from secondary sources, such as skimmings and alloys. T. R. Janes, assigned to Superior Zinc Corp. No. 2,267,698.

B.F.Goodrich

Traction Express tires give coal hauler up to 90,000 miles before retreading

THAT hopper-bottom trailer has just emerged from a coal-loading tunnel at Guntersville, Ala., ready for the 75-mile trip to Rome, Ga. It's one of a fleet owned by the Coal Transportation Co. that works 18 hours a day, 6 days a week, hauling 20-ton loads over winding, mountainous roads.

"We have a hauling job that is particularly hard on tires," says President Taft Chatham, "but we find B.F.Goodrich Traction Express tires give better service than any other make we have ever used!" Traction Express tires give this company up to 90,000 original miles—then 2 retreads! Blowouts and tread separations are almost unknown!

Like all B.F.Goodrich tires for mine work, the Traction Express is built with a FLEX-RITE NYLON cord body. B.F.Goodrich FLEX-RITE NYLON withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder this B.F.Goodrich construction outwears even the extra-thick Traction Express tread, can often be retreaded again and again.

See your B.F.Goodrich Smileage dealer today. He has B.F.Goodrich tires for your mining jobs that will save you money, give you longer service. Your dealer is listed under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

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New **Longer-Wearing** Pattern in Wire Rope Styles!

After three years of extensive field trials this, the newest of Roebling's wire ropes, is now ready to go to work for you on a service basis that will exceed that of *the wire rope you are now using*.

Roebling Herringbone* combines the best features of both regular and Lang lay rope constructions; being made up of two *pairs* of Lang lay strands and two strands of regular lay. The regular lay strands separate the two pairs of Lang lay strands. Thus, in one rope you have the superior flexibility and abrasion resistance of Lang lay and the greater structural stability of regular lay.

For the past three years, under all kinds of conditions, Herringbone has been used for general hoisting, holding and closing lines, shovel ropes, wagon scraper ropes and dragline ropes. The results have been wonderful . . . excellent flexibility, exceptional resistance to shock and abrasion, smooth, easy operation around drums and over sheaves, smooth spooling properties and structural stability unequalled by other rope for the same job.

There has never been a better time—or a wider need—for a wire rope that returns so much service for its cost. And, in addition to being a top performer on the job, Herringbone eliminates the necessity of stocking Lang lay for one purpose and regular lay for another.

You are invited to get in touch with your Roebling distributor or write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for further and fuller details on the *investment* qualities of this new and highly serviceable rope.

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In financial aid to education . . .

What Should Business Do Now?

Now that the federal government is entering the field, should business firms stop giving financial aid to our colleges and universities?

This question is now being discussed by business directors throughout the country. The discussion is prompted by the near-billion-dollar program of federal aid to education passed by Congress a few months ago. For if the federal government, with its access to billions in taxes, is assuming responsibility for the financial welfare of education, should not business get out of the way and let the government take over? This is the general way the question is being asked.

The answer is a resounding NO.

What The Federal Program Does

The new federal program makes it possible for the government to spend the imposing total of $900 million for aid to education over the next four years. There are still many loose ends in the program. But already it's quite clear what such funds will — and will not — do to help relieve the financial plight of our colleges and universities.

First of all, the program is not going to solve any financial problems in education overnight. The program is just barely underway. So far no money has actually been allocated, and Congress has appropriated only $40 million — less than 5% of the total.

More important, there is very little in the total program which will result in direct aid to colleges and universities. The program does set up fellowships to train college teachers. But most of the aid will eventually be channeled through the states to primary and secondary schools. The main focus of the program is education for national defense — strengthening science, mathematics and foreign languages in elementary and secondary schools, together with grants for counseling, testing and research.

The one big item for higher education is a $295 million student loan program, which will help needy students pay tuition and other fees. But tuition rarely covers the full cost to the college of educating a student. So the net result could well be an additional financial strain on our institutions of higher learning.

For the three most pressing financial needs — faculty salaries, scholarship grants and new plant and equipment—colleges and universities must still rely heavily on help from the business community. And it would indeed be a major

misfortune if the recent actions of the government put a blight on this growing and substantial support to higher education.

In the last ten years, business has expanded its financial aid to education by more than four fold. In 1948, contributions were only $24 million. In 1957, such aid reached an estimated $125 million. Moreover, corporations have been putting a larger proportion of their total charitable gifts into education. In 1950, the percentage was only 17%. By pre-Sputnik 1956, the share had already increased to 34%, according to figures recently released by the Council for Financial Aid to Education.

Why Business Must Help

The most compelling reason for increasing business aid to higher education — at an even faster rate—is that our colleges and universities desperately need financial help. It is that simple. Private contributions to higher education must average at least $400 million over the next ten years if our colleges are to meet rising operating costs and raise faculty salaries to decent levels. Despite the growth in business contributions, we are still well below that goal.

If our colleges cannot solve their mounting financial difficulties through voluntary help from business firms, alumni and communities — then it is to be expected that federal aid ultimately will be mobilized in a big way. In principle, if not in dollars, the 85th Congress has paved the way. Indeed, a large federal scholarship program was squeezed out of this year's legislation only in the course of last-minute compromises. And Arthur S. Flemming, Secretary of Health, Education and Welfare, has urged that the next session of Congress restore the scholarship program.

About any federal rescue operation for higher education, two things are quite clear:

(1) **Such aid will come too late to prevent irreparable harm resulting from the current shortage of funds.** The need for help is urgent and immediate.

(2) **With federal taxes taking over half of all corporate income, any federal program in the end will be financed in large part by the business community.**

An Opportunity

So, viewed narrowly, it is in the selfish interest of business firms to aid our colleges and universities now, rather than wait and be forced to pay later on. By doing so, they ensure that business will have a continuing supply of well-trained graduates. They take advantage of the tax laws for charitable contributions which mean the government in effect assumes more than half the cost of business aid to education. And they win gratitude for a voluntary and generous act.

Viewed in the broad public interest, the business community has an opportunity to perform a financial rescue mission in education which could well be the key to successful survival, not only of our present system of higher education, but also of the nation itself.

As previous editorials in this series have pointed out, a very small share of the net income of business firms — about 1% — would do the job. Certainly business must not be distracted from this opportunity by the new venture of the federal government in financial aid to education.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

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When you use this new Timken® bit you drill rock—not chips—because chips clear faster. Its newly positioned 5 front holes jet-propel air or water against the rock face. And deeper, wider wing clearance and deeper relief under the heel help clear the chips extra fast. This quick wash-back ends the problem of clogged drill steels, protects your bit skirts against damage, lets you drill more feet-per-bit.

You get even more hole-per-bit because new special analysis carbides give this new Timken threaded bit greater resistance to shock and wear. And you can recondition it many times. Its redesigned heavier wing speeds drilling. Improved thread contact cuts breakage to a minimum.

For drifters, sinkers and stopers, this new Timken threaded carbide bit is the one to give you more hole-per-bit. For a free brochure that gives all the details write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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Improved Timken all steel multi-use bit gives you lowest cost per foot-of-hole—with correct, controlled reconditioning—when you can drill full increments of steel.

New Timken tapered socket bit is removable for full steel life, tapered for more secure union, and has same new frontal features as threaded bit. It's the air-leg bit of the future—here today!

TIMKEN REMOVABLE ROCK BITS

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PERSONALS

RECEPTIONIST at Shannon Free Airport welcomes the visitors to the Emerald Isle.

Canadian Officials Visit Irish Copper Mines

Leading Canadian mining and government officials en route to the opening of the St. Patrick's Copper Mines, Avoca, County Wicklow, Ireland, were greeted at Shannon Free Airport by receptionist **Riana Maher** (right). They were (left to right): **H. W. Knight,** director of Irish Copper Mines Ltd.; **J. W. Spooner,** minister of mines, lands and forests; **Charles McTague,** chairman, St. Patrick's Copper Mines Ltd. and president of Irish Copper Mines Ltd.; and **D. R. Michener,** speaker of the Canadian House of Commons. The opening of the new mines took place Oct. 15 with Ireland's Minister for Industry and Commerce, Sean Lemass, presiding. (See *E&MJ*, May 1958, p 82.)

R. A. Elliott has joined the firm of Ensio, Whiton & Associates Ltd., mine, mill and smelter engineers, Toronto, to do consulting work in the mineral beneficiation field and to manage the firm's ore testing and chemical laboratory in Montreal.

Gordon H. Gibbs, until recently a consultant with Advocate Mines Ltd. at the company's asbestos deposit in Newfoundland, and formerly with International Nickel and Hollinger and manager of Flintkote's asbestos mine in Thetford Mines, has established an independent consulting mining engineer practice in Toronto.

Owen G. Jarvis has been named Salt Lake district manager, Gardner-Denver Co., succeeding **Frank B. Matheson,** who has retired after 48 years of service. Jarvis, who started his mining career at Chief Consolidated Mining Co., joined Gardner-Denver in 1935 as field engineer.

W. H. H. Cranmer, president of New Park Mining Co., was presented with the "Award of Distinguished Citizenship" by W. F. Nicholson, mayor of Denver, on the occasion of the city's 100th birthday anniversary. Mr. Cranmer, a graduate of Yale University, who started his mining career as a youth at Cripple Creek district, was cited for his service to Colorado and the recognition he has secured in American mining.

Rip V. Thompson is now metallurgist in charge of research and the erection of the 100-ton pilot plant (to treat a lead-silver orebody at McCracken Mt.). The work is being done for the Ari-Vada Development Co. of the Mojave Co., Arizona.

H. S. McGowan, president of La Luz Mines Ltd., Siuna, Nicaragua, has been elected vice president and general manager of Ventures, Ltd.

Margasahyam V. S. K. Iyer and **Subhas K. Datta,** two engineers from India, have begun a five-month study of American mining techniques at U.S. Steels' Oliver Iron Mining Division operations on the Mesabi iron range.

S. K. Garrett is now chief geologist for the Sunshine Mining Co. of Idaho's mining exploratory program.

Carlton D. Bailey has been appointed supervisor of training for Oliver Iron Mining division's Hibbing-Chisholm district, succeeding **A. E. Hermann,** who was recently made superintendent of industrial relations.

Ralph G. Brown, president of Western Gold & Uranium Inc., was recently elected as chairman of the board.

Hugo Riemer was recently appointed to the newly created position of executive vice president of United States Borax & Chemical Corp. and was also elected to the board of directors, as was **Norman Travis,** of London. Riemer was formerly president of the company's nitrogen division. Travis, currently a director of Borax (Holdings) Limited, succeeds **D. Abel Smith** who has resigned.

Officers of the re-constituted Hidden Splendor Mining Co., upon completion of merger of Hidden Splendor, Atlas Corp. subsidiary; Rio de Oro Uranium Mines, Lisbon Uranium, Radium King Uranium, etc., will be: **David A. Stretch,** executive vice president of Atlas, as chairman of executive committee; **A. P. Kibbe,** Salt Lake City, president; **W. Rodney deVilliers,** Albuquerque, N.M., Rio de Oro president, as senior vice president at Albuquerque; **N. W. Stalheim,** an executive assistant of Floyd Odlum, as vice president; and **D. I. Hayes,** former chief of mining for American Zinc Lead & Smelting Co., as vice president and general manager. Hidden Splendor will have operating headquarters in Salt Lake City.

Robert Nell, mining engineer formerly employed in Colorado, is now with M. A. Hanna Co., Iron River district, in the safety department.

Franklin G. Pardee, former president of American Iron Ore Association, Cleveland, has opened an office in Crystal Falls, Mich. as consulting mining engineer and geologist.

John Ballantine Knaebel, of Grants, N.M., consultant to the Anaconda Co., has been voted by the AIME board of directors to receive the William Lawrence Saunders gold medal, for 1958. Presentation will be at AIME's annual meeting in San Francisco in February 1959.

Knaebel

Knaebel took his B.S. (Eng.) degree in 1929 from Stanford University, and his E.M. a year later. He was, successively, with the USBM as assistant mining engineer in Washington, D.C., and Berkeley and San Francisco, Calif.; with East Mindanao Mining Co., Philippines; as superintendent, manager; consultant, mine examinations, in the U.S., Canada, Mexico and Central America; managing director, Amparo Mining Co. of Canada, Ltd., B.C., superintendent, assistant manager, USSR&M, Bayard, N.M.; superintendent, Gold Hill Arsenic Mine, Utah; assistant to vice president, assistant manager, Western Mines, USSR&M, Salt Lake City. From 1946-50, Knaebel was in charge of an Anaconda exploration project in British Guiana and Brazil and managed Anaconda British Guiana Mines Ltd., and Mineracao Gurupi, S.A. From 1951-56 he managed Anaconda's New Mexico Operations, becoming assistant to vice president in charge of mining operations in 1956; and a consultant to Anaconda in 1958.

Slag removal at Jones & Laughlin's plant is a job that never ends. J & L knows from 14 years' experience that the rugged Mack chassis is built to take the strain of year-in, year-out slag hauling, and keep coming back for more.

J & L's Macks maintain dependable hauling schedules for 14 years

From 1944 until 1956, Jones & Laughlin operated eight Mack 30-ton dumpers to haul slag at their Aliquippa, Pa., plant. As a result of their dependability, low operating costs and capacity, when it came time to retire these Macks in 1956, J & L replaced them with five Mack 30-ton dumpers.

The five new Macks are hauling the same total amount as the eight models they replaced, and are performing so well that J & L expects them to haul one-third again as much slag, as soon as additional production facilities are put into operation.

There's a Mack that can handle any tough hauling job—in strip mines, in quarries, or in general construction work. Mack dumpers have what you need to speed up production—maneuverability for really fast spotting and dumping—the Mack Balanced Bogie with Power Divider, for positive traction under extreme road and weather conditions—economical operation and minimum down time—and other Mack cost-cutting features that add up to more profitable operation for you.

Find out what Mack dependability can do for your operation. Check with your Mack branch or distributor soon. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

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PERSONALS *(Continued)*

Neaman

Wight

Charles A. Wight has been named president of Freeport Sulphur Co., succeeding Langbourne M. Williams, who is chairman of the board and chief executive officer. **Pearson E. Neaman** was made chairman of the executive committee, succeeding Mr. Wight. Mr. Neaman, formerly senior vice president and general counsel, will continue as general counsel. A graduate of Yale University in 1922, Mr. Wight joined Freeport in 1948. He previously had been a vice president of Bankers Trust Co. Mr. Neaman, a graduate of Harvard College in 1924, and Harvard Law School in 1927, has been with Freeport since 1930.

C. R. Knowles, assistant chief engineer for Pickands, Mather & Co. in the Hibbing area, has retired.

Byron Rowell, formerly supervisor of training, has been made mill engineer at Oliver Iron Mining's Extaca plant in Virginia, Minn. **Wayne E. Tuomi** succeeds him in his former post.

Edmund T. Montgomery succeeds **Rollin N. Dow** as secretary of E. J. Longyear Co. and the Canadian Longyear, Ltd. Dow has retired. **John F. Hoffmeister,** consulting engineer, has been named chief engineer for the Minneapolis firm.

William G. Hewitt has been appointed to the newly created position of marketing analyst for the Bunker Hill Co., Kellogg, Idaho. He was president of Pacific Guano Co., Berkeley, Calif. from 1953, and with Pacific Chemical & Fertilizer Co. in Honolulu for 13 years, the last three as vice president and assistant general manager.

Leonard L. Hank, formerly vice president in charge of manufacturing for National Gypsum Co., has been promoted to vice president of operations. He succeeds **Wells F. Anderson,** who died Sept. 21.

Miss Sheila Deane, formerly geologist for Texas Gulf Sulphur Co., left recently for England.

P. J. O'Brien has been appointed vice president of production and engineering for U.S. Borax and Chemical Corp., Los Angeles, Calif.

J. Price Briscoe, William C. Russell Jr., Leroy Giles, and **Harry Walder,** incumbent officers of the Clear Creek-Gilpin Metal Mining Association, were re-elected for the ensuing year, as president, vice president, secretary and treasurer, respectively.

John Parden has been appointed assistant superintendent of maintenance in Oliver Iron Mining Division's eastern district, Virginia-Eveleth. **William Bush** has been appointed operating engineer and **Robert Graham** has been advanced to industrial engineer from mining engineer.

Theodore J. Green has been appointed assistant mine inspector for the northern district of Nevada and will make his headquarters in Ely, covering Humboldt, Lander, Eureka, Pershing and White Pine counties.

C. DeWitt Smith has opened a consulting office at Bedford Road, Lincoln, Mass. He was most recently vice president of the Copper Range Co. A holder of a B.S. degree in geology from Yale University, and a B.Sc. in mining engineering from Queen's University, Smith began his career as a miner and engineer for Phelps Dodge Corp., Bisbee, Ariz. Since then, he has been commodity specialist (copper, lead, zinc) with Foreign Economic Administration, Washington, D.C.; in mine research for St. Joseph Lead Co., 1946-1949, at Bonne Terre, Mo., mine captain at Leadwood, Mo., to 1950, superintendent of mines, Balmat, N. Y. to 1953, mining engineer, New York 1957, when he was made assistant vice president. He was also assistant treasurer and director of Leadridge Mining Co. Ltd., Canada, 1953-August 1957; 1957-August 1957, secretary, Compania Minerales Santander (Peru); to August 1957, vice president, secretary and director, Compania Minera San Jose de Colombia. He is a member of the Mining and Metallurgical Society of America, AIME, CIM, and the Mining Club.

Smith

William Kennedy, of Portland, Ore., is the new chairman of the governing board of the Oregon Department of Geology and Mineral Industries. He was appointed to fill the vacancy on the board created by the death of **Mason Bingham.**

Avery C. Adams succeeded **Admiral Ben Moreell** as chairman of Jones & Laughlin Steel Corp. upon Admiral Moreell's retirement Oct. 1. Mr. Adams will continue as president and chief executive officer.

Harry F. McFarland, consulting mining engineer of Denver, is now on assignment for the International Labor Office (United Nations) in Rangoon, Burma, until April. His mailing address: c/o Resident Representative, U.N.-T.A.B., 12 Newlyn Road, Rangoon, Burma.

P. H. Mulcahy has been named general manager of Wemco division of Western Machinery Co. of San Francisco.

Byron Rowell is now mill engineer at the Extaca taconite agglomerating plant in Virginia, Minn. **Wayne E. Tuomi** succeeds him as training supervisor at Oliver Iron Mining division plant. **William L. Bush** is now operating engineer at the Rouchleau mine, Eveleth, and **Robert D. Graham** was named industrial engineer in Oliver's Eastern district.

Percy H. Royster, Silver Springs, Md., who retired from the USBM in August, has been presented with the Department of Interior's Distinguished Service award and Gold medal. Recognized internationally as an authority on blast furnace theory and practice, Royster served 17 years with the USBM. His blast furnace work of 40 years includes many outstanding contributions to the iron smelting industry.

John H. East Jr., of Denver, regional director of Bureau of Mines' 8-state Region III, has been voted the Department of the Interior's distinguished service award and gold medal, in recognition of more than 20 years of achievement in mining engineering, health and safety work, executive administration, and as an author of several publications, mainly in the mine safety field.

Robert C. Meaders was recently appointed assistant manager of the mining, crushing and process machinery division of Nordberg Manufacturing Co., Milwaukee, Wis. Meaders was formerly vice president of Aerofall Mills, Inc., Columbus, O., subsidiary of the Toronto company, and had been affiliated with Carborundum Co., Niagara Falls, N.Y. as a research and mineral dressing engineer and with Patino Mines & Enterprises Consolidated, Inc. as plant superintendent of their Bolivian tin operations. **D. A. Cheyette,** division vice president, was named executive director, and **Jack B. Bond** was made general manager of the division.

Meaders

OBITUARIES

William R. Hubbard, 60, of Elvins, Mo., employee at the Federal Mine of St. Joseph Lead Co., died Oct. 17.

Robert E. Sullivan, 69, retired general mine foreman of Kennecott Copper Co. in Alaska, died Oct. 13 in Oakland, Calif. His home was in Seattle, Wash.

James E. Jewell, 62, geologist, died in Bonne Terre, Mo., July 9, 1958. With St. Joseph Lead Co. since 1925, he was for the past eight years general superintendent in charge of diamond drill operations in Southeast Missouri.

(Continued on page 182)

MINING INDUSTRY USA

NEW WHEAT NATIONAL MODEL MINER'S CAP LAMP A SENSATION IN THE FIELD- 30% MORE LIGHT AT NO INCREASE IN WEIGHT- A PERFECT SPOT WITHOUT TOOLS- TWO EQUAL WORKING FILAMENTS IN KRYPTON GAS-FILLED BULB= FAMED WHEAT TRUE AUTOMATIC CHARGING- MUCH MORE TO SHOW- BE SEEING YOU=

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AUDIENCE PARTICIPATION was facilitated by roving microphones in Mayo Auditorium where sessions were held.

RECESS in the foyer gave operators, researchers and manufacturers a further chance to exchange ideas over coffee.

Symposium Views Production Drilling

MEATY PAPERS AND LIVELY DISCUSSIONS held the attention of nearly 200 participants in the Drilling and Blasting Symposium at the University of Minnesota in Minneapolis, Oct. 2 through 4. It was the eighth annual mining symposium conducted by the School of Mines and Metallurgy and was the first in a continuing series which will also include Rock Mechanics and Exploration Drilling, presented jointly with Colorado School of Mines and Pennsylvania State University on a rotating host basis. Published proceedings will be available shortly from the Center for Continuation Studies, University of Minnesota, Minneapolis 14, Minn.

Large underground excavation practice on Swedish civil engineering projects was a feature of the sessions. It was covered in the guest lecture *Developments in Drilling and Blasting Practice in Europe* prepared by Dr. K. H. Fraenkel, director of engineering of the Swedish State Power Board and editor of the "Manual on Rock Blasting." It was delivered by Erik Ryd, deputy managing director of Atlas Copco AB, and was supplemented by a film.

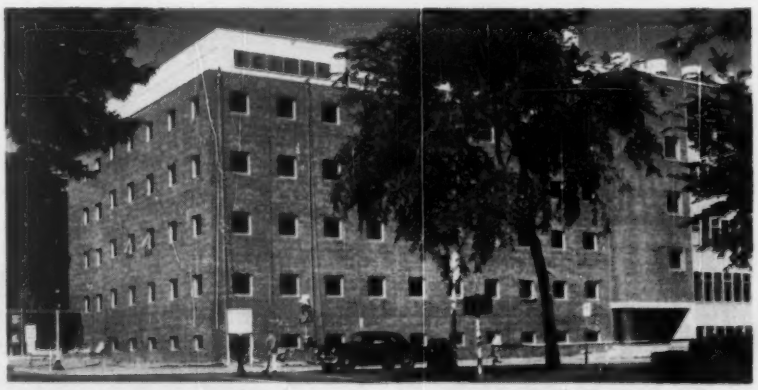
This lecture also gave examples of the considerable work that has been done in deriving planning formulae and graphs for such factors as costs of mining, speed of drilling, hole spacing, rate of excavation, desirable degree of mechanization, etc. The audience seemed particularly interested in these operating ideas: equipping miners with gas masks to permit reentering heading almost immediately after a blast; use of one operator for several drills, especially when using a wheeled jumbo having a single horizontal arm on which eight or more drifters are mounted (see *E&MJ*, July 1956); dynamite cartridges up to 5 ft long which can also be used in a pneumatic charging apparatus; use of less powerful explosive in trimmer holes to reduce wall fracturing and slabbing; and pre-drilling the entire length of raises from one set-up using a large-relief-hole burn-cut pattern and blasting in short lifts.

Some politico-economic aspects of the mining industry were examined by Dr. John O. Ridge, professor of mineral economics and assistant dean of the College of Mineral Industries at Penn State. His talk, *The Mineral Subsidy Program*, followed the Friday evening social hour and dinner.

He pointed out that because of the current world wide political conflict and the ultra-critical nature of mineral raw materials both in economic and military warfare, it is beyond question that the mineral industry of the U.S. and its close neighbors must be strong enough to satisfy certain essential needs on a normal basis. In any program aimed at meeting these needs, he emphasized, exploration and process research must be sufficient to insure availability, or research must be sufficient to find substitute materials.

In outlining the several current legislative schemes for maintaining an essential level of domestic production—sliding scale tariffs, subsidies with production quotas, and import quotas—as well as international commodity agreements, Dr. Ridge showed that each has merits and faults. He concluded that to be at all effective, all of them must be used; and, thus, the problem is whether to accept controls "whole hog" or not at all.

Technical sessions began on Thursday morning after welcoming remarks by those involved in preparing for the meeting: J. M. Nolte, dean, and Fred E. Berger, head of the Center for Continuation Studies, both of the General Extension Division, and Eugene P. Pfleider, chief of the Division of Mineral Engineering of the School of Mines and Metallurgy of the Institute of Technology, all of the University of Minnesota; Howard L. Hartman, head of the department of mining at Penn State; and Lute J. Parkinson, head of the department of mining at Colorado. Dr. Donald H. Yardley of Minnesota was particularly commended for his work over the summer months during the absence of Prof. Pfleider. *(Continued)*



NEW BUILDING for School of Mines, under construction on University of Minnesota campus in Minneapolis, was toured by symposium group in a brief interlude following lunch on the second day.

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When you phone an order or request information, the Sales Office Manager in Oakland with whom you speak can contact the plant at WEST END immediately. He talks by private wire teletype with the Production Manager on product availability . . . Shipping Superintendent on packaging, transport facilities, dates and car numbers . . . Technical Director on detailed specifications . . . Plant Manager on the development of products to meet new applications or specifications. An answer or firm commitment is given immediately. It is relayed to you often while you are still on the phone.

WEST END's Sales Office Manager sales representatives and plant executives work together as a team manning a system that is, in our opinion, uniquely outstanding in the chemical industry. Their confidence in the efficiency of this system is reflected in the enthusiastic, helpful and friendly manner in which they promptly serve you . . . our customers.

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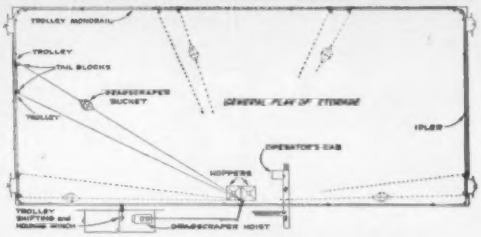
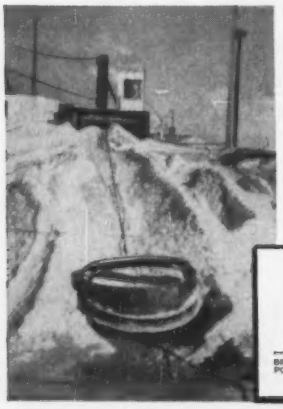
Three Sauerman Methods for Cutting Storage and Reclamation Costs

INDOOR RECLAMATION

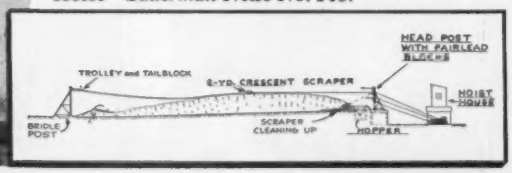
DragScraper with Trolley and Monorail—Material dropped onto stockpiles from an overhead conveyor is reclaimed to hoppers by a 2½-cu. yd. DragScraper. The installation uses a monorail and trolley system to permit shifting of the scraper bucket by remote control from operator's station at right.—*Sauerman News No. 143.*



OPEN STORAGE

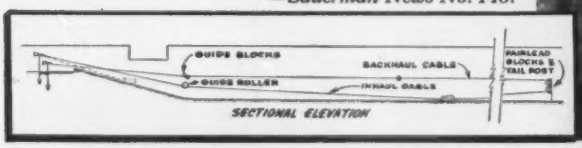


DragScraper with Trolley and Elevated Bridle—DragScraper is reclaiming raw potash to hopper from storage pile. Material is dumped at rear of the pile and moved closer to hopper during intervals when mill requirements are satisfied. Trolley and tail block travel on an elevated bridle between two stiff-leg bridle posts. Shifting of the trolley is provided by a third drum on the Sauerman DragScraper Hoist—*Sauerman News No. 146.*



HANDLING HOT MATERIAL

DragScraper—Hot scale is dropped from ingot buggy track into tunnel and is conveyed by DragScraper to a water sluiceway for disposal. Safety is important here—personnel and vulnerable equipment do not enter the hazardous area.
—*Sauerman News No. 146.*



Find out what the Sauerman Method can do for you

Give us details on your operation. Our engineers will give prompt recommendations and work with you to provide the best method for your requirements. Ask for Catalogs A (DragScrapers) and E (Bulk Storage by DragScraper).

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Symposium (*Continued*)

Production Drilling led off the sessions.

Vertical and Horizontal Blastholes in Strip Mining was discussed first by Howard E. Herzog, head drilling and shooting foreman of Peabody Coal Co., St. Louis. The advantages of horizontal and slightly inclined-up holes have encouraged the company to develop better drills by remounting large vertical machines. Their goal is a unit for drilling 12-in.x150-ft holes both horizontally and vertically. Stemming plugs of plaster encased in asbestos cement appear to be handy cost savers.

Western Copper Pit Practice was next reviewed by Adolph Soderberg, consulting mining engineer with Kennecott Copper Corp., Salt Lake City. There is a trend toward closer engineering control in drilling and blasting operations. Other highlights included: injection of small amounts of water into the compressed air entering the hole which not only is a simple way to kill the dust but also tends to mud-case the hole in fractured ground; the wide use of AN-oil because of dry conditions and mixing and charging it with a pneumatic blower; and drill and drill-cab booms mounted on various vehicles for fast, convenient secondary drilling.

Down-the-hole Percussion Drill Development, Construction and Application were covered by Robert T. Macaul, director of Drillmaster sales for Ingersoll-Rand Co., New York. Elimination of energy losses in the drill rod, independently adjusted rotation, straight uniform holes in irregular formations and fast drilling in hard formations were among the benefits cited. In the discussion it was indicated that when ground conditions are such that rotary roller-cone drilling rates fall below 50 ft per hour and bit costs rise above 10c per ft, a change to percussion down-the-hole drilling is warranted. Work continues toward developing a bit larger than the 9-in. dia one now available.

Drill Steel, the afternoon session, began with *Hollow Drill Steel Progress* by Howard T. Crombie, mettallurgist, Crucible Steel Co., Pittsburgh. Improved manufacturing processes as paced by changes in drill bits were chronicled along with current problems and solutions in rod life and the recent wider interest in factory-made rods which are case hardened by carburizing and then shot-peening.

Percussion Drill Steel Problems at Climax were explained by Max R. Ahrens, physical metallurgist for American Metals-Climax at the Colorado mine. Test equipment and procedures in solving the problems were outlined. Some general data on fatigue life and mechanism of failure, as well as photos of common types of failure, were presented. In a supplementary comment, spiral-rolling (surface hardening by cold-rolling grooves) was mentioned as advantageous for rods with taper connections but threaded rods with forged shoulders are a problem for present equipment.

Yes! . . . it's ALL STEEL

HP RANGE:
½ to 50 hp

RATIOS:
4:1—14:1—24:1 (or 20:1)

OUTPUT SPEED RANGE:
420 to 5 rpm

TORQUE RATINGS:
up to 31,500 lb-in

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ALL STEEL
Shaft Mounted Drive

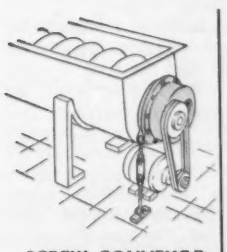
. . . Steel can "take it"!

STEEL frame . . . of fabricated plate supports all rotating elements—provides double the ability of iron to maintain vital alignment of revolving elements, even under shock load or external impact.

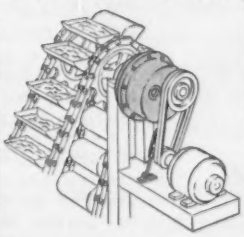
STEEL housing . . . will not fracture, serves only as protective cover and lubricant reservoir. Therefore, lubricant supply is safeguarded.

STEEL tie-rod and straddle-mounted tie rod brackets . . . are fastened to heavy steel frame by steel bolts in double shear.

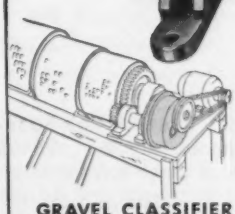
A FEW TYPICAL APPLICATIONS



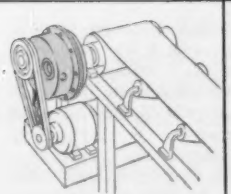
SCREW CONVEYOR



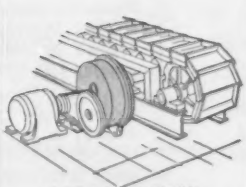
BUCKET ELEVATOR



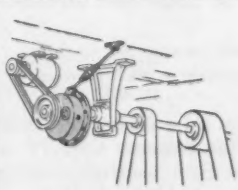
GRAVEL CLASSIFIER



BELT CONVEYOR



APRON FEEDER



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Off-the-shelf delivery **from your Authorized Falk Distributor.** ***Shipment from factory or warehouse stocks*** **within 72 hours after receipt of your order.**

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Now you thread 4", 4½", 5" and 6" pipe with only One set of dies with the New RIDGID

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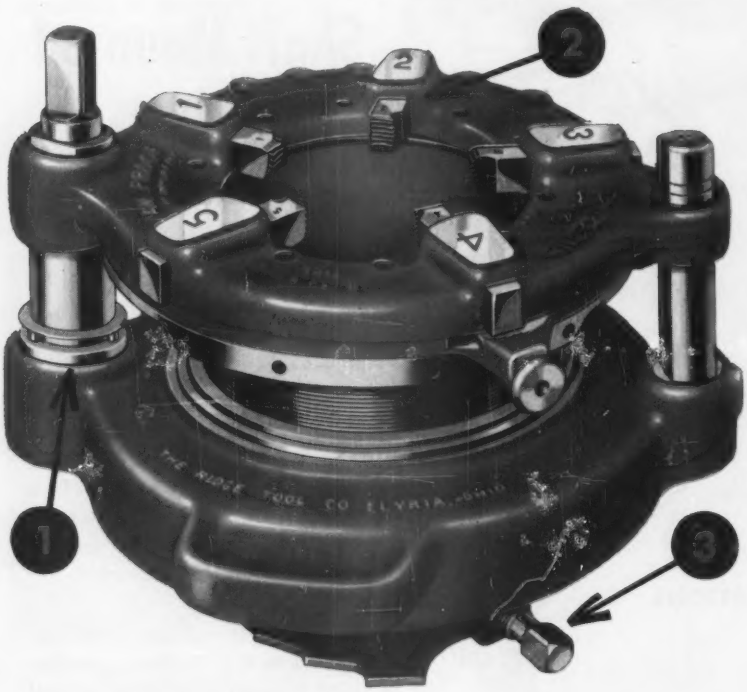

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2. Only 1 Set of High Speed Dies threads 4", 4½", 5" and 6" pipe. 2 quick release knobs for fast size settings. Adjustable for tapered or straight, over or under size threads.

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What's more the new No. 161 has all the time-saving and proved performance features that have made the RIDGID 65R-TC and 4PJ Threaders the world's most popular. Save time on your large pipe jobs . . . order the 161 from your Supply House today!

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Symposium *(Continued)*

This session concluded with the guest lecture and the movie.

Blasting was the session on Friday morning and it witnessed spirited discussion.

Some New Practices in the Use of Ammonium Nitrate were dealt with by Dort F. Tikker of Monsanto Chemical Co., St. Louis. For one thing, it appears that there are no adverse effects from water if less than 10% by weight enters the mix. Parameters that affect AN explosive blasting and some effects that appear to contradict accepted concepts were also considered. One of these is the benefit of continuous priming by using very heavy detonating fuse. The discussion indicated that such practice may be useful in insuring that an explosion takes place through the entire hole but that it probably does not produce the most desirable explosive reaction and blasting action. Secondly, it appears that small tetryl wafers spaced along the explosive column is a cheaper means of "boostering."

Ammonium Nitrate Blasting at Iron Ore Of Canada was the subject of a paper by Henry E. Farnam, IOCO's manager of operations, Sept-Isles, Quebec. Through the aid of Dr. M. A. Cook, the wet hole problem has been best solved by developing a powerful, very safe, cheap water slurry of fertilizer grade ammonium nitrate and TNT that can be loaded directly into water-filled holes. Another successful solution was careful charging of AN-oil mix using a placement tube to prevent water enveloping the prills. For dry holes, bulk AN and fuel oil will be mixed in a highly automatic plant at the mine site and then transported and charged into the holes using a tank truck with screw conveyor bottom and a compressed air blowpipe. Small pentolite pellet primers and tiny tetryl wafer boosters were also mentioned as inexpensive but dependable accessories.

Millisecond Delay Blasting by Eldridge M. Fowler, technical representative with DuPont in Wilmington, detailed the many advantages and featured the use in pulling long rounds in drifts on the Michigan iron ranges.

Characteristics of Pit Blasts in taconite and limestone were shown in remarkably excellent high-speed films and concisely described in the accompanying paper by Gordon E. Frantti, USBM geophysicist at Hibbing. The later discussion centered on the reflection scabbing theory.

Research was Friday afternoon's topic.

Rock Penetration by a Wedge was described by John B. Cheatham Jr., engineer with Shell Development Co. in Houston. The ductile nature of rock under high pressure is particularly evident in his experiments.

Stress Waves in Percussion Drill Rods were considered by Charles Fairhurst, assistant professor at Minnesota, in describing work done by himself and Dong Kie Kim, graduate student. The influence of piston shape, weight and

NEW S-12

joins Euclid Rear-Dump Line!

The Model S-12 Euclid-Easton hauler—with payload capacity of 44,000 lbs.—is a new size Euclid over-hung engine type semi-trailer rear-dump. Designed and built as a complete, balanced unit, it combines the experience of two leading manufacturers of hauling equipment for mines, quarries and heavy industrial and construction work.

With 218 h.p. and 5-speed gear transmission the S-12 has a fast travel speed and ample power for the toughest jobs. Big 24.00 x 25 tires on all wheels provide traction and flotation for operation under conditions that would stop other haulers. For work in close quarters the 90° hydraulic steering and variable wheel base gives the unit exceptional maneuverability and helps cut cycle time.

Well reinforced body is constructed of special alloy steel to withstand the impacts of shovel-loaded rock and heavy excavation. Single stage double-acting hoists raise the body quickly, with smooth positive control all during the dumping cycle.

Have your Euclid dealer show you how this Model S-12, or the 12 and 35 ton semi-trailer models with 143 and 325 h.p., can cut hauling costs. He'll be glad to tell you about other Rear-Dump "Eucs" of 10 to 50 ton capacity, too.

EUCLID Division of General Motors Corp., Cleveland 17, Ohio

22-ton capacity
14 yds. struck
218 h.p.
24.00 x 25 tires
22.6 mph top speed

Euclid semi-trailer rear-dumps are available in 3 capacities—12, 22 and 35 tons with 143, 218 and 325 h.p. Tractors for these models are interchangeable on 7, 12 and 21 yd. scrapers.

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EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

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The Wemco Mobil-Mill:

Standard of Heavy Media Separation Plants; Operators' Choice — World Wide

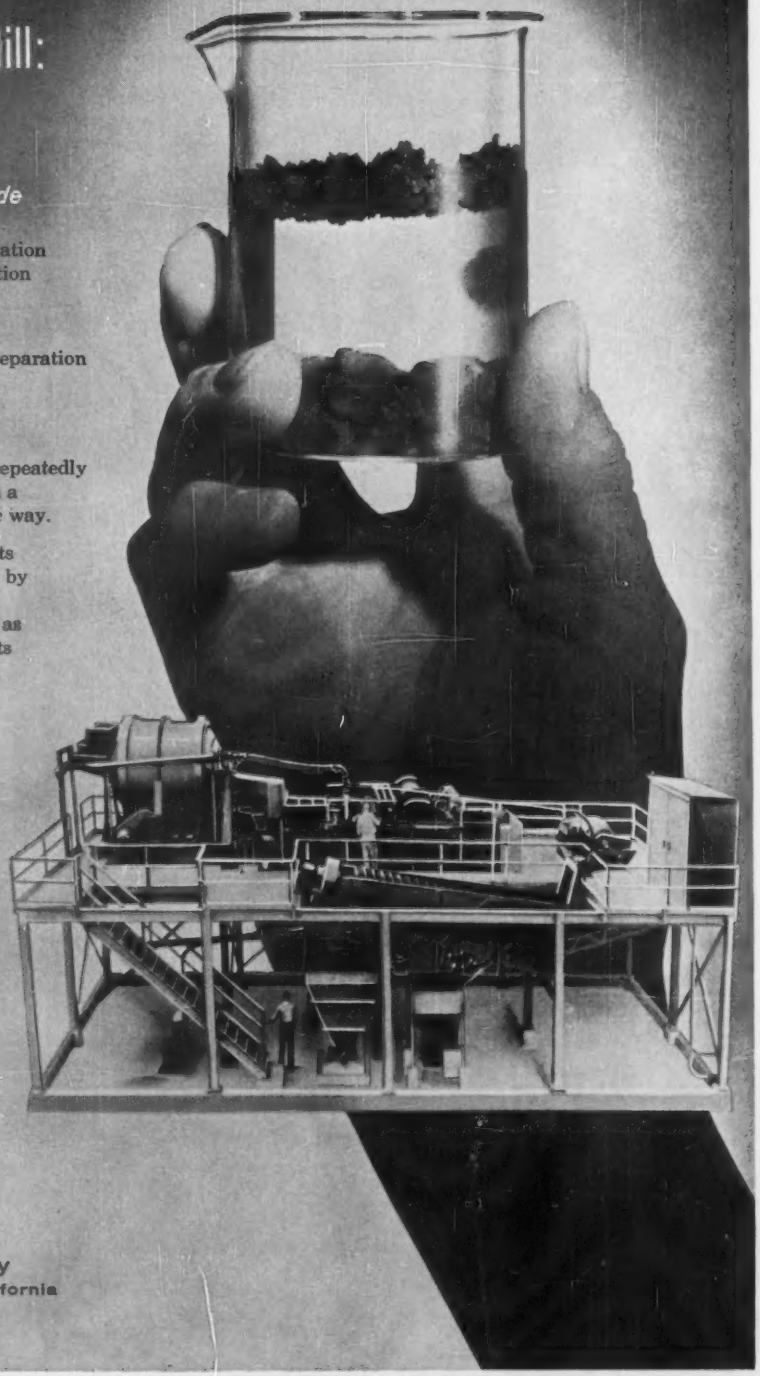
The choice of the Heavy Media Separation process for profitable premium production is a sound one.

And the use of the one-man-operated Wemco Mobil-Mill for Heavy Media Separation is more and more a standard for optimum results.

The reason: complete, pre-engineered, pre-fabricated and integrated design, repeatedly proved to answer recovery problems in a low-cost, low-maintenance, *dependable* way.

The Wemco Mobil-Mill is known for its ease and rapidity of erection — even by inexperienced personnel; proved for profitable operation from the first day as evidenced by the wide number of plants in successful operation the world over.

Depend on the Wemco Mobil-Mill — and the skills behind it.



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Symposium *(Continued)*

velocity is especially important in the transmission of energy down the rod.

Stress Waves in Rock were discussed by Arthur W. Ruff, assistant mine superintendent for Cananea Consolidated Copper, Cananea, Sonora. His strain-gage oscillograms were used to select the explosives for particular underground uses. The graphs also show that the better fragmentation with millisecond delays is not a result of seismic-wave interference. So far, varying small amounts of stemming has not affected the seismic-wave but larger amounts may affect the gas-pressure heave effects. Post-paper talk gave some insight, yet revealed the lack of information as to the nature and related effects of shock-waves, seismic-waves and gas-pressure heave. An especially interesting aspect was that the shock-wave resulting from the clash of seismic-waves may be the basis for straight-line fracturing between simultaneous blasts whereas single shots tend to crater.

Equipment and Typical Results in Blasting Research were described by George B. Huber, mining engineer with Stanford Research Institute, Menlo Park, Calif. The highly informative and pictorial presentation included one sidelight on secondary blasting: a very successful mudcapping test in which a very thin strip of explosive (⅔ lb of C-4) about 6-ft long broke a 5-ft dia boulder.

General Review on Saturday morning embraced a huge field.

New Ideas and Techniques by Lloyd E. Antonides, associate editor of *E&MJ*, presented a scrapbook of brief items on theory, practice and equipment.

A panel discussion which followed included short summaries of company activities by:

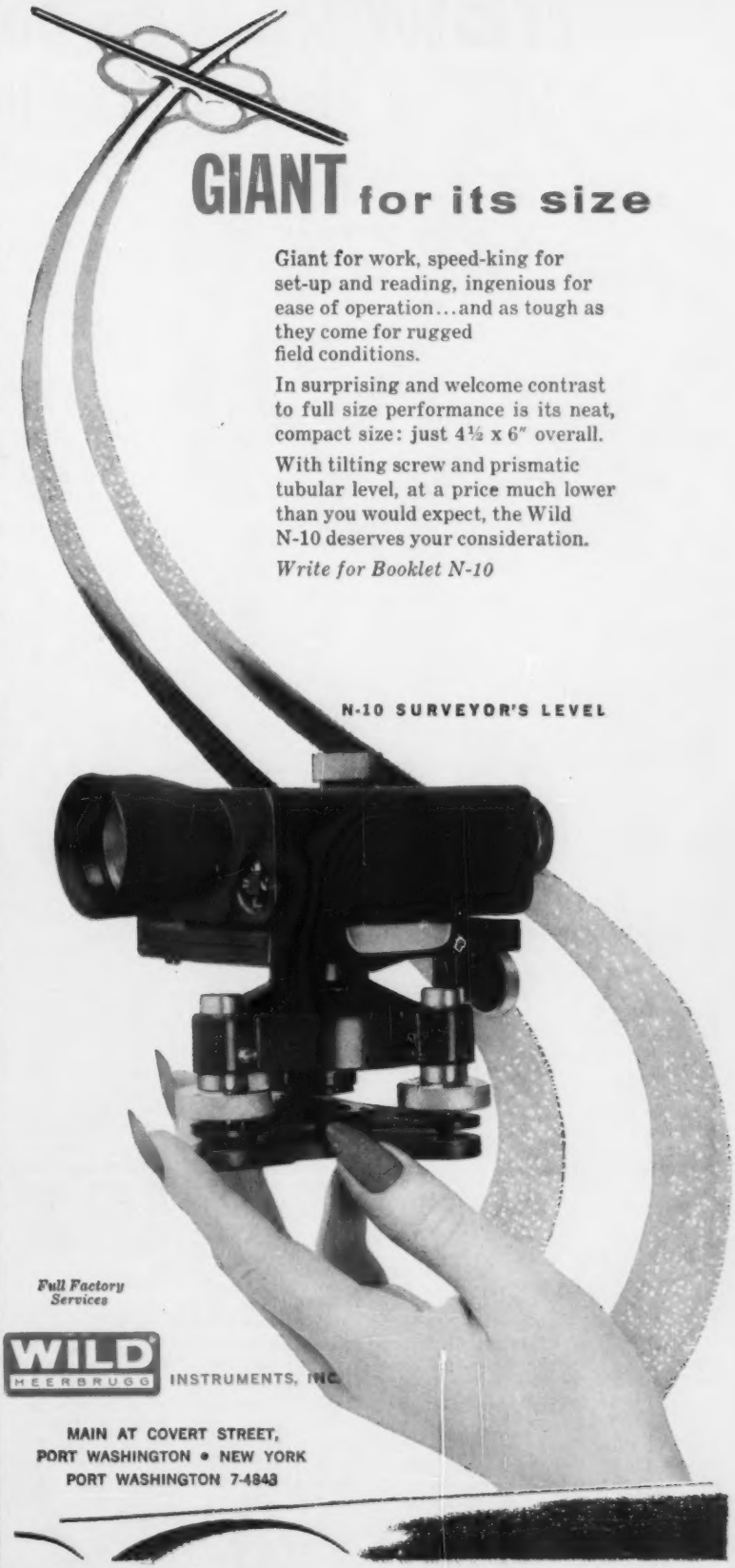
Robert Akre, drilling and blasting superintendent of Maumee Collieries, Terre Haute, Ind. Premixed and packaged AN agents are preferred because of their uniformity and higher efficiency.

Kenneth Ed, explosive division sales of Canadian Industries Ltd., Montreal, Quebec. Although the water slurried AN-TNT agents are about 1½ times as expensive as prill-oil mixes, they have greater power and velocity, permitting larger burdens.

Warren Larsen, engineer with Al Johnson Construction Co., Minneapolis. Rock excavation under water on the Detroit River (Amherstburg Channel) required particular attention to blasting vibrations; and a drilling barge for mounting 20 parallel drifters proved excellent.

Alfred F. Savage, superintendent of the Plummer mine, Oliver Mining division, U.S. Steel Corp., Coleraine, Minn. On the Mesabi, AN is in common use, rotary rigs are boon, and down-the-hole drills are promising.

Erik Ryd, Atlas Copco AB, Stockholm, Sweden. Labor and drill steel are the items that should prove most fruitful for research since they account for 50% and 30%, respectively, of the drilling costs.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Giant for work, speed-king for set-up and reading, ingenious for ease of operation...and as tough as they come for rugged field conditions.
In surprising and welcome contrast to full size performance is its neat, compact size: just 4½ x 6" overall.
With tilting screw and prismatic tubular level, at a price much lower than you would expect, the Wild N-10 deserves your consideration.
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BECOLOY Makes the Difference On This Digging Dragline Bucket

Bucyrus-Erie BECOLOY buckets are built to outlast . . . designed to outstrip! BECOLOY, an exclusive alloy, makes the buckets tough . . . cuts weight while increasing strength. Performance-tested tooth and lip angle make them dig in fast, slice through smoothly for faster filling.

New-design Bucyrus-Erie BECOLOY buckets ride through the swing smoother because they're better balanced to cut bobbing and spillage. The dump is quick and complete, cutting seconds off every cycle.

See your distributor for details on light, medium, and heavy-duty types, solid or perforated.

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BECOLOY is used on arch, clevis plates, lip, and teeth. It has a tough, fibrous structure that imparts high strength.

Symposium *(Continued)*

Chairmen of the various sessions were as follows:

John Haivala, superintendent of methods research for Cleveland-Cliffs Iron Co., Ishpeming, Mich.—Production Drilling

Ed J. Eisenach, general superintendent, American Metals-Climax Inc., Climax, Colo.—Drill Steels

George B. Clark, chairman, department of mining engineering, Missouri School of Mines and Metallurgy, Rolla, Mo.—Blasting

John S. Rinehart, professor of mining engineering, Colorado School of Mines, Golden, Colo.—Research

Prof. Pfleider moderated the review panel discussion.

Kremer Bain Is Awarded Shaft Method Royalties

IN AN ACTION brought at Albuquerque, New Mexico, by C. Kremer Bain, St. Louis mining engineer, against McKenzie & Whittle Contractors, United States District Judge Waldo H. Rogers last June held that McKenzie and Whittle were using Bain's patented method for shaft sinking in an operation near Carlsbad, New Mexico. The shaft was being sunk for Farm Chemical Resource Development Corporation for the mining of potash. Judge Rogers held that McKenzie & Whittle should pay Mr. Bain royalties for the use of his method and that incidental changes in the shaft sinking did not free the user from an obligation to pay royalties. The judgment was paid and satisfied on August 12, 1958.

IN THE U. S.

ARIZONA

Arizona's State Employment Security Commission has upheld a ruling that college students may draw unemployment compensation because summer jobs they held in 1957 with Phelps Dodge Corp. were not available in 1958. In so doing, the commission granted jobless pay to seven students.

Earlier Phelps Dodge sued in superior court over a similar case involving 16 other students.

Those students have been judged eligible for an average of 13 weeks' unemployment pay at $28, $29, or $30 a week, depending on individual cases. Phelps Dodge protests that money paid students will come from the general unemployment compensation fund with a "consequent reduction of said fund to which plaintiff is a sizeable contributor."

Phelps Dodge complained that by the consequences of the decision, it "might be compelled by business necessity to discontinue its program of summer employment for qualified college students."

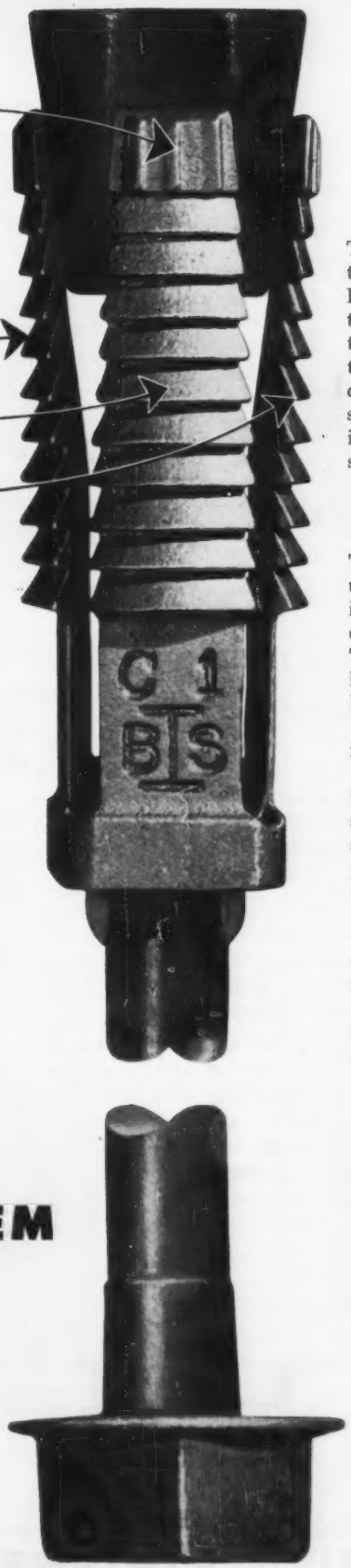
Students involved were employed in the Morenci area in summer months to enable them to earn money to pay school expenses. Because PD was on a four-day week during the summer months this year the jobs were not again available.

CALIFORNIA

Barite findings on property owned by Emil Ritter of Caliente, 15 miles east of Caliente, are undergoing testing pending development of the findings. Coring started early in the fall, and a road was bulldozed into the rugged mountain area. The road is reported to have a 10% grade in places. The area first became noted in the 1860's with the discovery of gold. Later, tungsten was taken out in large quantities. Traces of uranium have been found. Recent findings of antimony are undergoing testing.

Kern Uranium Co.'s Little Sparkler mine in Kern River Canyon went back into operation early this fall after a lengthy shutdown caused by the deflated market for uranium ore. Eleven men are employed on two shifts per day, Lloyd Scouler of Rio Vista, president of the company, reports. Original plans called for the mine to go back into production in the early summer.

Here's where it takes hold



This is the expansion shell used on the end of a Bethlehem Headed Roof Bolt. Inserted in a hole drilled into the mine roof, the serrated leaves of the shell expand quickly when the tightening of the bolt draws the plug down on the threads. In a matter of seconds, the shell and bolt are locked in the hole, thus providing a firm, secure roof.

HEADED BOLT COMES IN 3 SIZES

The Bethlehem Headed Roof Bolt, used with the malleable-iron shell, is furnished in three diameters, each of which is made in varying lengths. The ¾-in. carbon bolt and the ⅝-in. high-strength bolt have a typical breaking load of 24,000 lb; and the ⅞-in. high-strength bolt has a typical breaking load of 45,000 lb.

We also manufacture a 1-in. slotted roof bolt, which is used with a steel wedge. Either bolt, headed or slotted, can be used with square plate washers, angle washers, or roof ties.

Why not include roof bolting as part of your safety program? If you will contact the nearest Bethlehem sales office, we'll arrange to have an experienced engineer discuss bolting techniques at your properties, and render assistance to bolting crews.

BETHLEHEM STEEL COMPANY
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On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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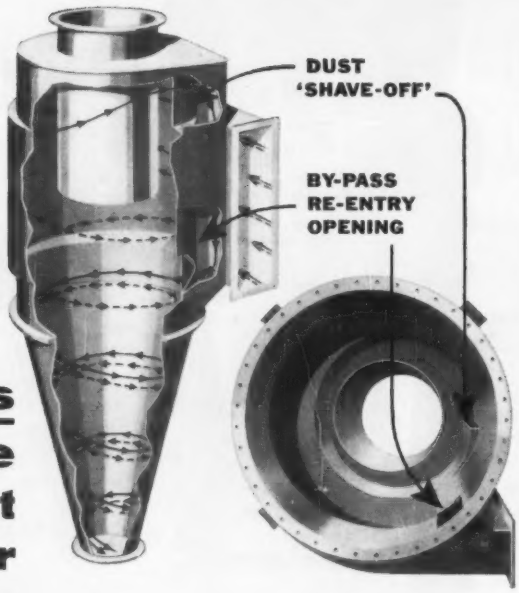
BETHLEHEM STEEL

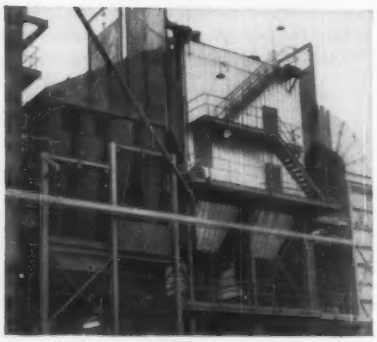


This Cyclone won't clog or plug

Buell's exclusive 'Shave-off' design permits large diameter cyclones that will not clog, plug, or bridge when properly operated: you avoid unnecessary maintenance work or process interruptions.

The unique Shave-off port traps the dust that whirls upward in double-eddy currents, increases cyclone efficiency by eliminating this source of dust reentrainment. Whether installed singly or in groups, Buell Cyclones are the most efficient ever developed.

Other features include extra heavy plate construction for longer service life, Buell-designed manifolds for more efficient, non-turbulent flow of dust-laden gases . . . and the confidence assured by a history of hundreds of installations everywhere in America. Write for a copy of the 12-page booklet, "The Exclusive Buell Cyclone": Dept. **19-L**, Buell Engineering Company, Inc., 123 William St., New York 38.



Large-diameter Buell Cyclones in series with Buell 'SF' Electric Precipitator.

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Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

California (*Continued*)

Development work will consist of sinking an existing main shaft in the footwall to 160 ft, cross-cutting and drifting. Work has started on a winze in the orebody to a depth of at least 160 ft, to further prove and delineate mineralization below the existing level, Scouler reports. He says, "The structure on which we are working does not permit successful diamond coring; so the winze will enable us to look at a potentially interesting target area. We have only about 25 tons of 0.50% or better ore currently in stockpile. Additions to the stockpile during the winze sinking operations are anticipated to be somewhat nominal."

A long string of legal fireworks have been shot off and now, as the result of the last blast, the discoverers of Miracle (uranium) Mine in Kern River Canyon are back in control of the mine and preparing to ship ore to Vitro Chemical Co. of Salt Lake City on a 200-ton contract.

Miracle Mining Co., with major stockholders in Taft and Bakersfield, recently won a default suit against Wyoming Gulf Sulphur Mining Co. and its subsidiary, Miracle Springs Mining Corp. The Kern County Superior Court gave clear title to Miracle and cancelled a $1-million lease-purchase agreement with Wyoming Gulf.

The plaintiffs requested lease cancellation after Western Gulf allegedly failed to comply with lease terms, including mine shaft improvements and production. Western closed down operations when mine properties became entangled in a maze of litigation. There has been no production for the past year and a half.

Brooks Mann, Taft tinsmith and resident of Miracle, and Chris Musick, Bakersfield painting contractor and stockholder, report that a skeleton crew has resumed production at the mine on a contract with Vitro. Ore is being stoped from a 450-ft tunnel.

The company property is made up of 20 claims approximately 150 ft from the canyon road near Miracle Hot Springs. Miracle is across the river from Kern Uranium Co.'s Little Sparkler Mine. Although production has been resumed, the mine is still "more or less in the development stage," Musick says.

J. P. Hall of Santa Cruz was uncontested for the post of president of the Western Mining Council in the election held at the council's annual meeting Nov. 1 at Yreka. Hall has held the post for the last 15 years. Twenty-one directors-at-large were selected.

A net loss of $1,759,301, after depreciation and estimated tax credit, was reported by the Bunker Hill Co. for the first nine months of 1958. President John D. Bradley said net current assets over this nine-month period declined only $354,107. During the same period of 1957, Bunker Hill earned $1,242,767.

The Bunker Hill president explained the loss was a result of the highest depreciation ($2,252,805) in the com-

Chevrolet's new El Camino combines fresh beauty with a husky pickup box that's 76¼" long, 64¼" wide.

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Or take the pickups of Task-Force 59—a *dozen* big-bodied beauties that suit scores of jobs with five handsome Fleetside models and seven handy Stepside models!

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Whether your truck is a light-, medium-, or heavy-duty job, these are trucks you've got to see! They're on display right now at your Chevy dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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NEW MIGHT, NEW MODELS, NEW MONEY-SAVING POWER! CHEVROLET

Le Roi CRD one-use bits were used to drill shot- and roof-bolt holes for this tunnel. Upper opening shown, is 43½ ft. wide.

Only CRD Bits Meet Glen Canyon Test

"The CRD one-use bit was superior to any of the ten brands we tested," reports superintendent.

Maintain 15 ft. daily pace through solid sandstone.

Pre-job tests revealed that the Le Roi CRD one-use bits offered the best cost-output advantages for the grueling job ahead. That's why they were chosen to drill two spillway tunnels through solid sandstone for the Glen Canyon Dam in Utah.

Here's how they scored. "Drilling in this sandstone," the tunnel superintendent reports, "the CRD bits averaged 48 ft., compared to an average of only 32 ft. for the other nine competing brands."

"Some bits were a little more durable," he adds. "But they cost up to $12 each, compared to the 24 cents we pay for each CRD bit."

Carbide bits were also tried, but proved impractical. The sand encountered on the job was as abrasive as the grinders used to sharpen the bits, causing them to lose their gauge too quickly.

Help Keep Schedule

On the job, the Le Roi bits are living up to expectations. "We use them to drill shot holes under the roughest conditions I've ever seen," the superintendent states.

In addition to the highly abrasive stone, the bits have to cope with mud and bad water seepage. Yet the bits average 4 to 4½ minutes per 18 ft. hole. As a result, "the first of the two long tunnels is being dug at an average rate of 15 ft. per day."

Le Roi H10AL air legs are used with the CRD one-use bits and comprise 95% of the drilling equipment used on the job. "The Le Roi units are doing a good job for us in the tunnel, helping us to keep the project on schedule," the superintendent concludes.

Investigate the advantages of low-cost Le Roi one-use bits for your next drilling job. Ask your Le Roi distributor about them, or write direct to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin. AT-723

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Newmatic® air tools, portable and Tractair® air compressors, and stationary air compressors. Write us for information on any of these products.

WABCO

California (*Continued*)

pany's history, heavy losses on metal sales due to metal market fluctuations, low prices for the first nine months for lead and zinc, curtailed operating rates and restricted sales.

Despite low metal prices, which were below the 20-year average for both lead and zinc, Bradley said the Bunker Hill Mine and the company's fabricating and oxide production units in Seattle operated profitably.

COLORADO

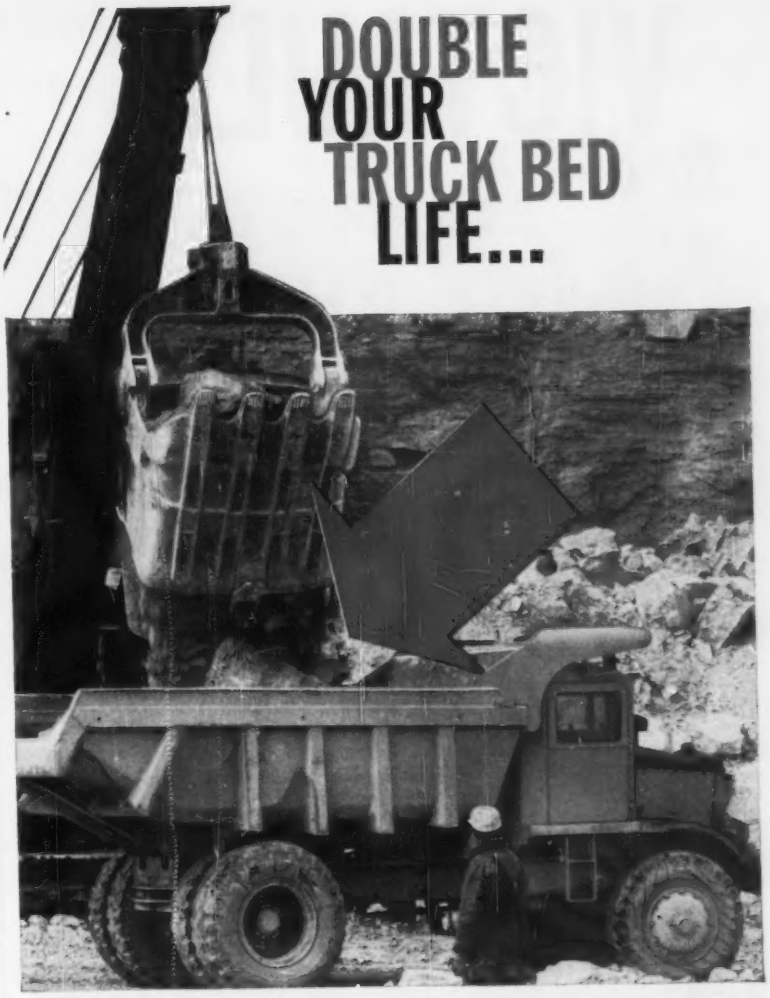
Emperius Mining Co. at Creede, closed a few months ago because of low domestic lead and zinc prices, has reopened on a limited scale, says Ty Poxson, president. The mines resumed operation around Oct. 1 and the mill Nov. 1. The mill operated on two 8-hour shifts daily at the start, handling about 80 tpd of rock.

Activity in the rare-earth industry in Colorado remained at relatively the the same level last year as in 1956. Rare earths sold in 1957 were valued at $20,000 and consisted principally of yttrium-bearing ores from Jefferson and Gilpin Counties and thorite from Custer and El Paso Counties. The most important producer of yttrium ores was Michigan Chemical Corp. Trail Mines, Inc. accounted for approximately half the thorite sold. Wah Chang Corp. at Sugarloaf (Boulder County) processed thorite and other rare-earth ores in 1957 and shipped the concentrates to eastern consumers.

Gendev Corp. has been organized in Colorado initially to acquire a 65-ton Mace Smelter, consolidating the assets and holdings of Carson Mining & Development Corp. and leasing and surveying the holdings of the Copperhead Group.

The staff is now comprised of: Sam S. Irving, vice president, operations; D. Atwood Knight, graduate mining engineer and geological consultant; John DuVall, smelter foreman and metallurgist; Edgar Reigel, mine superintendent, thorium division. In the first week of September, Gendev also opened up a thorium division. Contracts were reported with representatives of the owners of thorium holdings east of Westcliffe. The 65-ton smelter was delivered at the Copperhead Mine the last week of August. Test runs of Copperhead ores are being conducted.

Copper production in Colorado in 1957 increased 25% above 1956 but value of output declined 14% because of the drop in price for copper during 1957. The principal producer of copper in the State was the Treasury Tunnel-Black Bear-Smuggler Union group of mines located in the Upper San Miguel district of San Miguel County and operated by the Idarado Mining Co. An increased copper output by this company and by the second largest copper producer in the State in 1957, the New Jersey Zinc Co.'s Eagle mine in the



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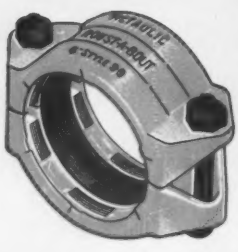

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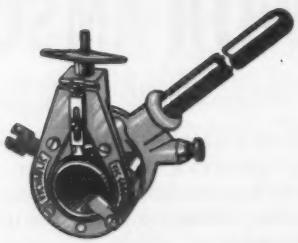

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Colorado *(Continued)*

Red Cliff district of Eagle County, accounted for most of the advance in copper production in Colorado last year.

Development of a silver-lead-zinc prospect in the Kerber Creek Mining District near Bonanza is being carried on by the St. Jude Mining Corp. Louis G. Dalio, president; Angelo Brothers, vice president; Jack C. Costanza secretary-treasurer, all of Pueblo.

The company at present has miners drifting on a large manganese stained vein that looks promising and expects to be into shipping ore shortly. Vein is heading in the direction of the Erie Mine, an old producer in the district and is believed to be an extension of the Erie vein system. This prospect is just two miles from a newly constructed selective-flotation custom mill. The corporation also has holdings in Hinsdale County.

Charles R. Hall, who has been in the Silverton area off and on for a number of years, has been doing considerable work on his San Juan County property, the Hamlet Group, the past season. Hall has some old assays on ore taken from the property which shows copper with value in gold, silver and lead. He hopes to have the mine in shape to work next summer, and has secured locomotives and cars. Thus, with the reopening of 2,000 ft of tunnel the past few seasons, Mr. Hall may join the list of operating mines before the end of 1959.

Fifteen to 20-million tons of columbite ore, a base metal for high temperature alloys, are estimated to exist in the Powderhorn area, according to a consultant geologist of the E. I. duPont deNemours and Co.

Dr. Warren Wagner was the speaker to members of the Colorado Plateau Section of the AIME, at Gunnison. He has been surveying the Powderhorn region since the summer of 1956 and drilled to a 100-ft depth in Iron Hill to derive the 15-to 20-million ton ore estimate.

"We don't have enough information at present to prove the economy of removing the ore," Dr. Wagner told the assembly. "Market research will take much time," he said.

Field work in the Powderhorn area's limestone deposits actually began in 1912, according to Dr. Wagner. Pyrochlore, a complex columbium mineral, was first found there in 1956 by Bob Grogan, assistant chief geologist for DuPont.

The metal is extremely expensive at the present, according to Dr. Wagner. A piece the size of a 50-cent piece costs $800. It ranges from $16 to $200 per lb. However, Dr. Wagner believes that if 250,000 tons can be produced annually, the price may be lowered to $10- to $12 per lb.

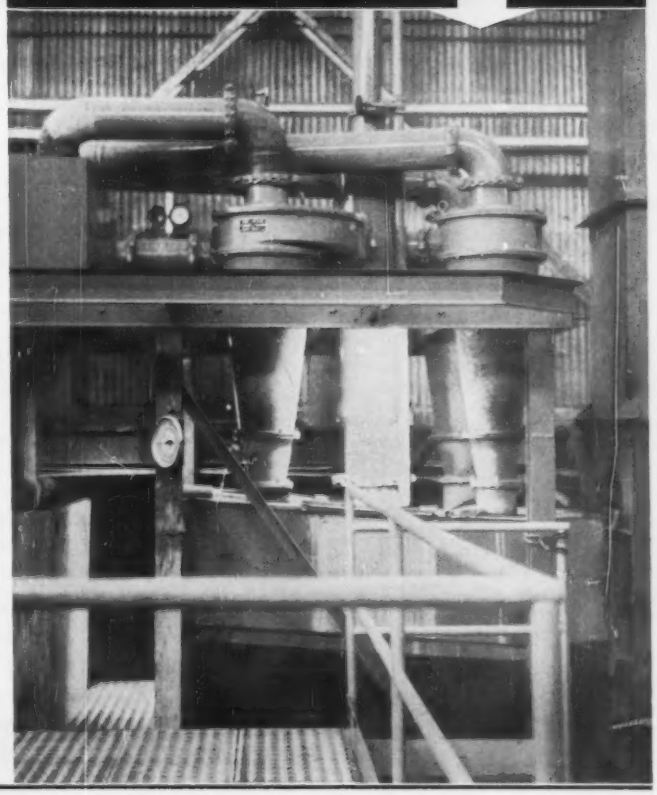
Columbite is an iron columbate, often containing manganese, and grading into tantalite. It is black and has a bright sub-metallic luster.

Silver receipts at the Denver Mint to-

Another copper concentrator changes to KREBS CYCLONES

Eight Model D10B Krebs Cyclones building berm for the tailings dam.

Southwest copper concentrator. Four Model D20 Krebs Cyclones in closed circuit on each of 4 plant sections with single stage grinding.



Eleven copper concentrators use Krebs Cyclones to handle their entire tonnage. Forty copper plants operate Krebs Cyclones for concentrate regrind classification, in Moly circuits, thickener-filter systems, milk of lime plants and in partial tonnage classification in primary or secondary grinding.

Many find this new technique gives lower operating and maintenance costs along with low capital cost. For most copper ores the impact on flotation performance (better density control and selective grind of middlings) reflects in better concentrate grade and lower tailings.

EQUIPMENT ENGINEERS INC.

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Colorado (*Continued*)

taled 818,824 oz worth $741,036 in September but fell short of the record 1,124,661 oz received in July, mint officials report. Volume was cut to a trickle of 7,144 oz in August by the trucking strike.

September 1957 receipts came to 14,789 oz valued at $13,360. At that time the world price exceeded the U. S. Government's fixed price of 90½c an oz for newly mined silver. The world price now is below the Government price.

Gold receipts for September were up to 57,644 oz valued at $2,017,558 this year from 55,102 oz worth $1,028,571 in 1957.

Rico Argentine Mining Co. at Rico, reports net income of $8,989 for the fiscal year ended June 30, 1958. This compares with a net loss of $197,804 for the previous fiscal year. Both figures are before depletion but after taxes and depreciation.

No ore was produced during the fiscal year from the lead-silver-zinc properties in southwestern Colorado. Gross income of $1,005,032 was largely from sale of products of the sulphuric acid plant the firm operates near the mine.

Sherman B. Hinckley, president, said of the mining operations: "Due to low metal prices, no lead-zinc or ore concentrates were sold during the year. This was the first time in 20 years the company had no income from nonferrous metal production. Development work was curtailed during the year because of low metal prices," he said.

Mr. Hinckley reported that a "block of lead-zinc ore was prepared for mining and is ready to be mined when metal prices justify."

A former gold mill at Leadville is being reconditioned and equipped as a pilot plant for the start of a manganese milling operation under a new process being developed by the Manganese Reduction Corp. This new Colorado corporation is headed by Paul M. White of Denver.

White said the Leadville enterprise will operate under a new, patented process for extracting manganese ore from the area. The process was developed to remove and free the manganese from complex ores and provide pure manganese for a manufacturing market. He said manganese has been available in the Leadville area during 60 years of mining activities but the cost was too high for a profitable market. Under the new, patented process, the pilot mill will be capable of turning out a minimum of five to eight tons of finished product per 24 hours, White said.

Axel Olson and Ernest Nolan, leasing below the tunnel level on the Ajax mine on Battle Mountain at Cripple Creek have made one of the richest shipments of ore recently received at the Carlton Mill. In late September they shipped a carload of gold ore from this Golden Cycle mine that settled better than 5 oz of gold, in excess of $175 per ton. The rich ore came from a winze being worked below the tunnel level. There is indication of more of the rich ore but work is impeded by water which must be pumped from the workings.

Epperson and Polkinghorn, who have been leasing on the 2600-ft level of the Ajax, will drive on 400 to cut the Bob Tail vein. The Bob Tail was the early day producer on the Portland and the pair hope to catch the good ore.

The company is continuing its diamond drilling program which is proving helpful in locating ore. In general, the Ajax ore is holding up in both quality and quantity.

GEORGIA

Georgia Marble Co. of Tate, in its explorational core drilling program at the Willingham-Little Stone Co. Division, Whitestone, has drilled vertically to a depth of 700 ft in the Murphy marble bed. This is thought to be the deepest penetration ever made in that formation.

IDAHO

Rare Metals Corp. of America has encountered encouraging columbium-tanta-

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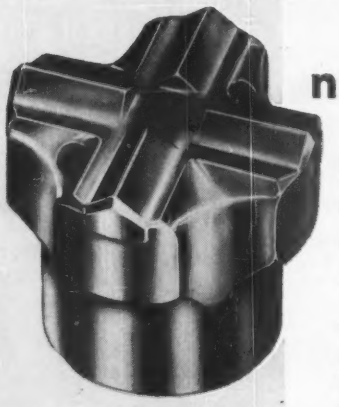
. . . the tungsten carbide bit that needs no resharpening



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No threads —
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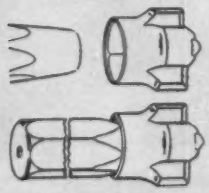

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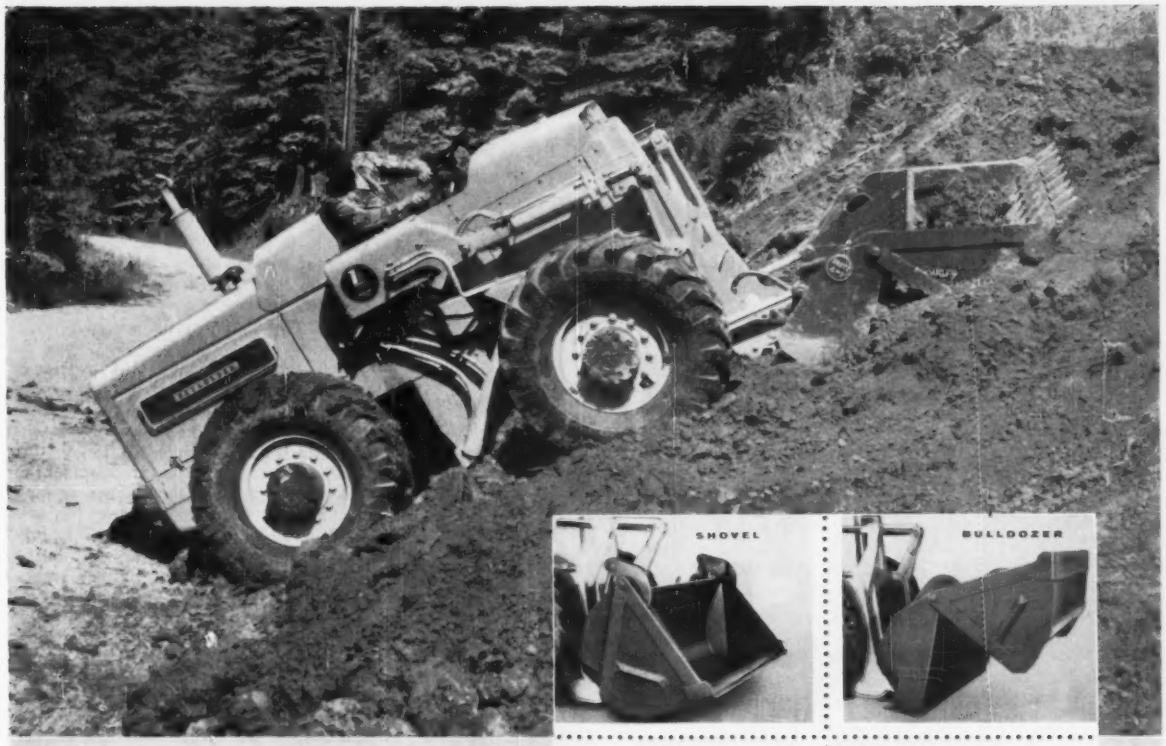

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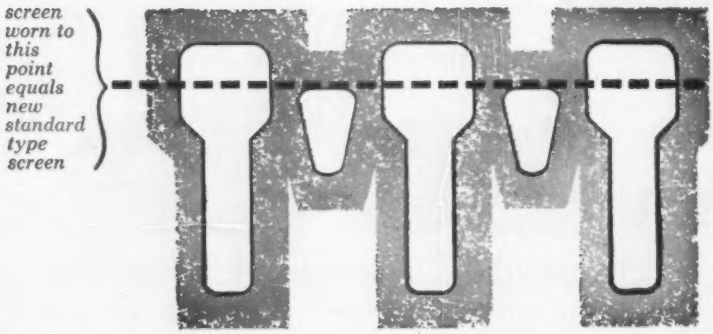

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Idaho (*Continued*)

lum values in prospect pits dug on an extensive area under lease in Idaho's Valley and Boise Counties.

The firm said it was ceasing work because of pending snow and weather factors but would return to the exploration and development program next spring.

Phillips Petroleum Co. anticipates shipment of some 600 tons of autunite-type uranium ore averaging 0.32% U_3O_8 from prospect pits developed to date in the Stanley Basin, about 62 miles north of Sun Valley.

The oil firm reports that it as yet has not made any major, substantial discovery of ore in this Stanley Basin area. But prospecting will continue as the evidence of uraniferous deposits is most encouraging. The ore, similar to that developed by the Dawn Mining Co. at the Midnite properties on the Spokane Indian reservation in Washington, is found disseminated in granitic rock along shear zones. Mined selectively by Halverson Construction Co., Jerome, on open pit contract basis with Phillips, values have run as high as 1% U_3O_8. (See below.)

Rock City Mining Co., recently-incorporated Kellogg firm, is now owner and operator of the promising new copper prospect in the North Fork drainage of the Coeur d'Alene District north of Prichard which Robert, Wilbur and Charles R. Hunt, three brothers, have been exploring for more than a year. Present efforts are concentrated on blocking out some tonnage for future mining in the new creek level tunnel which has been advanced about 110 ft on a 12-ft width of ore. During the past summer the Hunt brothers shipped several truckloads of ore stripped from the surface outcrop of the vein by bulldozer. Picked samples assayed as high as 60% copper and 4 oz silver per ton, with 0.4 oz gold and some lead. They have traced the huge outcrop for thousands of feet on the surface and uncovered ore showings on 10 claims. Robert Hunt is president of the new corporation, Wilbur is vice president and manager and Charles is a director. James Towles, Kellogg attorney, is secretary-treasurer.

The new enterprise is located on Brett Creek about two miles off the North Fork road north of Prichard. This area was the site of intensive prospecting around the turn of the century, following the gold rush at Murray, and a number of interesting copper-gold showings were found, but few were ever developed to any extent because of the lack of adequate transportation facilities.

Idaho Mining & Milling Co., Lewiston firm which has acquired more than 30 miles of stream-bed dredging gravel in the rich old Florence Basin of Idaho County, has concluded a three-year contract with Fisher Logging Co. of McMinnville, Ore., for the removal of timber from 8 miles of the dredging ground. The company expects to install a 2,000-cubic-yd bucketline floating dredge on Meadow Creek next spring

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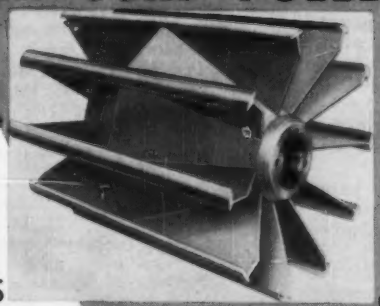

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Keeping Tabs on Practice

EVERY MONTH, *E&MJ* receives interesting items on mining and processing technology which cannot be given full editorial treatment because of space limitations, or which come under the heading of a news "brief." The source may be a paper presented at a meeting, an article in another journal, or a news item from one of our more than 60 correspondents all over the world.

Those items will appear, from time to time, in the pages of *E&MJ* to help you "keep tabs" on the latest progress in our industry.

Instrumentation advances and systematic investigation of rock characteristics in situ should greatly aid the search for minerals through the improvement of geophysical methods, according to George V. Keller of USGS, in his paper at AIME's Mid-America Minerals Conference, St. Louis, Mo. In concentrated work on the Lake Superior region, the results indicate electrical prospecting should be used to supplement magnetic and gravimetric surveys in locating taconite deposits and that induced polarization can be used to locate copper deposits.

A special rotary core drill for difficult formations of alternating soft to medium hard limonite and siderite in poorly consolidated plastic clays, silts and sands has proven effective for Lone Star Steel Co. in east Texas. The unit drills dry and has a single-piece long kelly, according to A. B. Drescher at Mid-America Minerals Conference.

Pillar recovery using systematic roof bolting and precise convergence measurements as a safety measure results in costs that are competitive with mining virgin ore now available to St. Joseph Lead Co. The practice was described by John J. Reed, mining researcher for the company, at the Mid-America Minerals Conference.

The Piokee Project conducted by Eagle-Picher Co. at Cardin, Okla., produced such startling results that management has invoked a general review of all their mining practices. A given block of low-grade ore was set aside and mined on a carefully controlled basis using the most suitable equipment available. Joseph B. Elizondo. Mid-America Minerals Conference.

Flow of bulk solids based on physical properties of the material has many applications to bin and pipe flow as well as other fields of mining such as block caving. Studies of these phenomena were discussed in a paper by A. W. Jenike, P. J. Elsey and R. H. Woolley at the Mid-American Minerals Conference.

In recent years St. Joseph Lead Co. has tried many innovations in their six "Lead-Belt" mills—Symons cones for secondary crushing, Allis-Chalmers rod mills for grinding, mechanical flotation cells, cyclones to deslime and dewater, pump wear parts of concrete, Linatex conveyor belt covering, polyethylene filter bags and cloth.

But here are some of the changes that may be expected in the future, according to H. A. Hoffman—all float recovery, all mechanical flotation (no more air cells), more cyclones, automatic reagent controls, continuous tailing analysis, and better plant-wide and inter-plant communication. Mid-America.

The R-N Process, a joint venture by Republic Steel and National Lead, may be applied to ores of high or low tenure to produce direct melting stock for electric furnace or other melting operations. Production quality and yield can be controlled in the kiln. Iron recovery is directly related to the percent metallization of the iron in the ore. Kiln lining life is excellent. The R-N Process is a practical, easily controlled process for a wide variety of ores and fuels. Low-grade peach seed briquettes (71% Fe) have been tested successfully in blast furnaces, and high-grade melting stock briquettes (95.2% Fe) have worked well in the electric furnace—from Dr. Donald E. Babcock, Republic Steel Corp., papers before recent American Iron and Steel Institute meetings in Birmingham, Ala., and Cleveland, O.

White Pine Copper Co. installed two-stage cyclones to discard low-copper slimes in first stage overflow; send second stage overflow to flotation and second stage underflow to regrind. Flotation practice will have to be altered to take advantage of better classification obtained, according to Virgil Lessels. Mid-America Minerals Conference.

Mineral dressing tests show that Pea Ridge deposit near Sullivan, Mo., responds to magnetic separation and flotation to yield concentrates ranging in iron content from 60 to 71.4% at recoveries of 89.9 to 97.6%, according to M. M. Fine and D. W. Frommer at Mid-America Minerals Conference. (See Missouri news.)

Texas Gulf Sulphur Co. has a difficult Frasch water handling problem at Spindletop Dome, Texas. Water is drawn at the rate of more than a million gpd from the Neches River and is chlorinated, clarified in precipitators with alum and activated silica, sand filtered, adjusted for proper pH with sodium carbonate, softened with zeolite, stripped of carbon dioxide and de-aerated before being used down the hole. Part of the water is used as boiler feed to preheat the mining water to 320 deg F. Still one other major problem is faced. What to do with the water coming out of the hole. Texas Gulf can't dump it as is, since they are working in a populated area and not out in the Gulf. Texas Gulf has to treat the effluent water with sulphuric acid to throw down soluble sulphides as sulphur and insoluble sulphur salts which are then removed in clarifiers before the water goes back into the river, pollution safe. From *Chemical Engineering,* Nov. 17, 1958.

Idaho *(Continued)*

ination of the Lucky Friday Mine east of Mullan, which is now developed to a depth of 3,050 ft and at last report was credited with reserves sufficient for nearly 20 years of operation at the current production rate of 180 tpd. Grade of the reserves is estimated at 18 oz silver, 8.8% lead and 1.4% zinc. Other Lucky Friday interests include 90% of the mineral rights on the adjoining 160-acre Jutila ranch, 50% of the adjoining Hunter Creek Mining Co. property, a lease from Day Mines Inc. on the adjoining Gold Hunter tract, and a 60% economic interest in the adjacent Lucky Friday Extension property.

Mining operations at the Bunker Hill Co.'s big Bunker Hill Mine at Kellogg were shut down for about a week in mid-October due to a major cave-in which occurred in the two-mile-long Kellogg adit tunnel which leads to the main shaft. About five sets of timber collapsed in the area where the tunnel crosses the big Osburn fault. Company officials said the temporary stoppage would not alter plans for stepping up production at the company's zinc plant and lead smelter during the early part of November from 65% to 80% of capacity.

American Smelting & Refining Co. has started deepening the main shaft at the Galena Mine west of Wallace from the 3,400 to the 4,000 level. The new lower station will be connected with the winze to that horizon completed earlier this and start working the gravel for gold and black sands containing heavy minerals.

The proposed merger of Polaris Mining Co. with Hecla Mining Co., its parent firm, was approved and ratified by overwhelming majorities by stockholders of both companies at special meetings Oct. 10 and became effective Oct. 31. Stockholders of the subsidiary firm will receive one share of Hecla for each six shares of Polaris held.

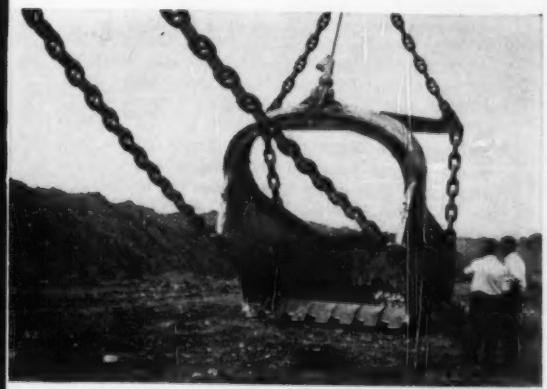
The consolidated company will have current assets of nearly $7-million and a net working capital of almost $6,200,000.

At the special Hecla meeting it was announced by President L. J. Randall that the company had taken an option to purchase a major stock interest in Lucky Friday Silver-Lead Mines Co. The option, which ran for 60 days to Dec. 1, covers 184,000 shares owned by Charles E. Horning, Lucky Friday president, and John A. Featherstone, vice president, representing approximately 14% of the 1,306,479 Lucky Friday shares outstanding. Option price is $7.50 a share, or $1,380,000, and if exercised Hecla would now be obligated to make the same offer of $7.50 a share to all other Lucky Friday shareholders.

Hecla's engineering and geological staff is now making a thorough exam-

"T-1" Steel bucket scoops 20% more load

—weighs 17,000 pounds less
—saves 50% of bucket costs



This USS "T-1" Steel bucket holds about 29 cubic yards loaded due to the unique fabricated lip design worked out by Mr. Miller. The former 25-yard rated bucket actually retained about 24 cubic yards loaded.

Warren Miller, master mechanic for Maumee Collieries Co., Terre Haute, Indiana, designed and built this bucket for one of the firm's large dragline rigs. He knew that capacity could be raised, over-all weight reduced and maintenance simplified if he fabricated the bucket entirely from plates of USS "T-1" Constructional Alloy Steel of 321 Brinell hardness.

Weight reduction. The bucket formerly used weighed 30 tons fully rigged, and scooped an average load of about 24 cubic yards. The new USS "T-1" Steel bucket weighs only 26 tons but delivers a load of 29 cubic yards—a capacity gain of 20% and an empty weight reduction of 25%. The loaded weight reduction is about 1%. Work per shift is up.

Cost reduction. Thanks to USS "T-1" Steel, the cost of this bucket was less than previous replacement costs. And a check on wear for the first four months of use indicated that the all "T-1" Steel bucket should last longer than buckets previously used. Maintenance will be simpler, too; no castings are used. The entire bucket is welded of plates.

Tooth talk. Maumee's bucket teeth are also made of "T-1" Steel instead of castings. They last about five weeks—two weeks longer than castings—and cost about half as much. All the "T-1" Steel used in the bucket was furnished to 321 Brinell which gives it extraordinary resistance to impact abrasion. USS "T-1" Steel is also available with a minimum yield strength of 100,000 psi.

Write for free book. The many advantages, applications and cost-saving features of this versatile steel are well known by equipment makers and completely described in our book, USS "T-1" Constructional Alloy Steel. United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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At this uranium mine, mixing could have been a serious problem.

In the mill's 16 x 20-foot precipitation tanks, alkali had to be dispersed quickly in the ore to produce uniform pH.

But mixing had to be *gentle*—or the delicate uranium oxide floc would break down into a powdery mass that could gum up the mill's filters and cause disastrous stoppages.

Solution: A LIGHTNIN Mixer representative made notes, took samples, and had a series of pilot tests run in the laboratory.

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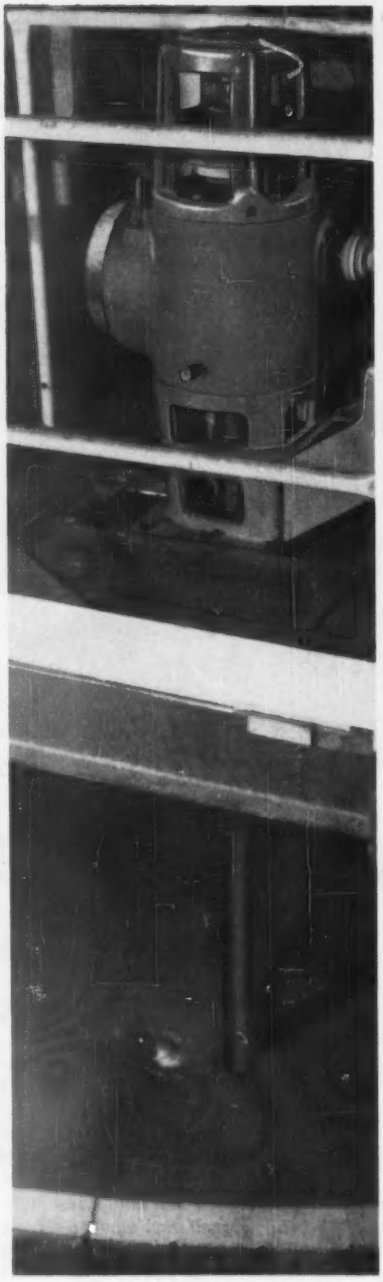

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Idaho (*Continued*)

year on the big silver vein which lies several hundred feet to the south. Sinking operations have been started on a two-shift basis but will be stepped up later to three shifts per day.

Asarco has also resumed five-day-a-week operations at its Page Mine west of Kellogg after more than 5 months on a four-day schedule. About 260 employes will benefit from the increased work-week.

Ore intercepts in three out of four holes drilled were the encouraging initial results of the extensive drilling program which Black Bear Silver-Lead Mines Co. is now carrying out at its extensive holdings on Canyon Creek northeast of Wallace. Sludge from the best showing averaged 28% lead and 11% zinc across a 3-ft width of vein in the Erin claim, held under lease from Coeur d'Alene Syndicate. Holes are now being run above and below the main adit level to determine the upward and downward continuity of the ore.

Western Fluorite Co., of Warren, Ark., pushed ahead at top speed with open-pit mining operations this fall at its uranium property on East Basin Creek in the Stanley area of Custer County in hopes of getting out more than 5,000 tons of ore before snow flies. By mid-October more than 500 tons had been shipped to Vitro Uranium Co.'s processing plant at Salt Lake City and another 1,000 tons had been stockpiled ready for shipment. Initial shipments averaged about 0.25% uranium oxide, but it was expected that the grade could be improved to at least 0.35% by more rigid control of mining operations. Hank Childs is superintendent of the property.

The Stanley area uranium prospects are generally regarded as the "hottest yet found in Idaho. Several large companies are active in the area including Phillips Petroleum, Rare Metals Corp. of America and Sidney Mining Co. of Kellogg. The latter has two groups of claims in the heart of the mineralized area—one a 14-claim group adjacent to the Western Fluorite holdings and the other a 17-claim group adjacent to a Rare Metals property. So far the company has done only a limited amount of surface bulldozing, but some interesting mineralization has been uncovered and additional exploration is planned after the snows recede next spring.

ILLINOIS

Rosiclare and Elizabethtown have been practicing what some of their leading citizens have been preaching with the inception of a fluoridated water system, which took place in mid-October.

The system differs from many others in the U.S. in that raw fluorspar is used, at a cost approximately one-third of other fluoride compounds, officials said.

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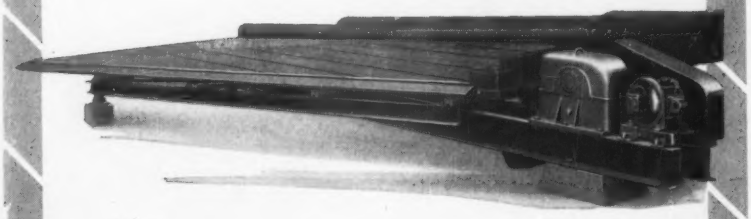

Inherent in the construction and operation of the SuperDuty DIAGONAL-DECK® Table is a complete balancing of all tabling factors to produce an efficiency unmatched in the mineral concentrating field.

To achieve this perfection it has been necessary to study each factor separately to be sure it exacts the last possible return. Head motion and deck action, riffling and pulp flow, disposition of valuable concentrates for most accurate cutting—all work together harmoniously, completely balanced for most efficient results. No other table or process is comparable. For full information send for Bulletin 118-C.

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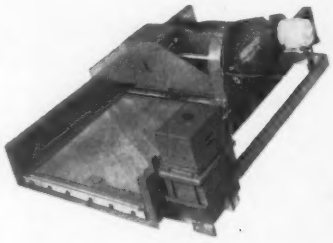

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Illinois (*Continued*)

Fluorspar producers have been requested to communicate with Leo A. Hoegh, director of Civil and Defense Mobilization, regarding an investigation of spar imports "to determine whether or not they are threatening to impair national security."

If he reaches an affirmative decision, the OCDM director must "promptly advise the President" to take action on imports.

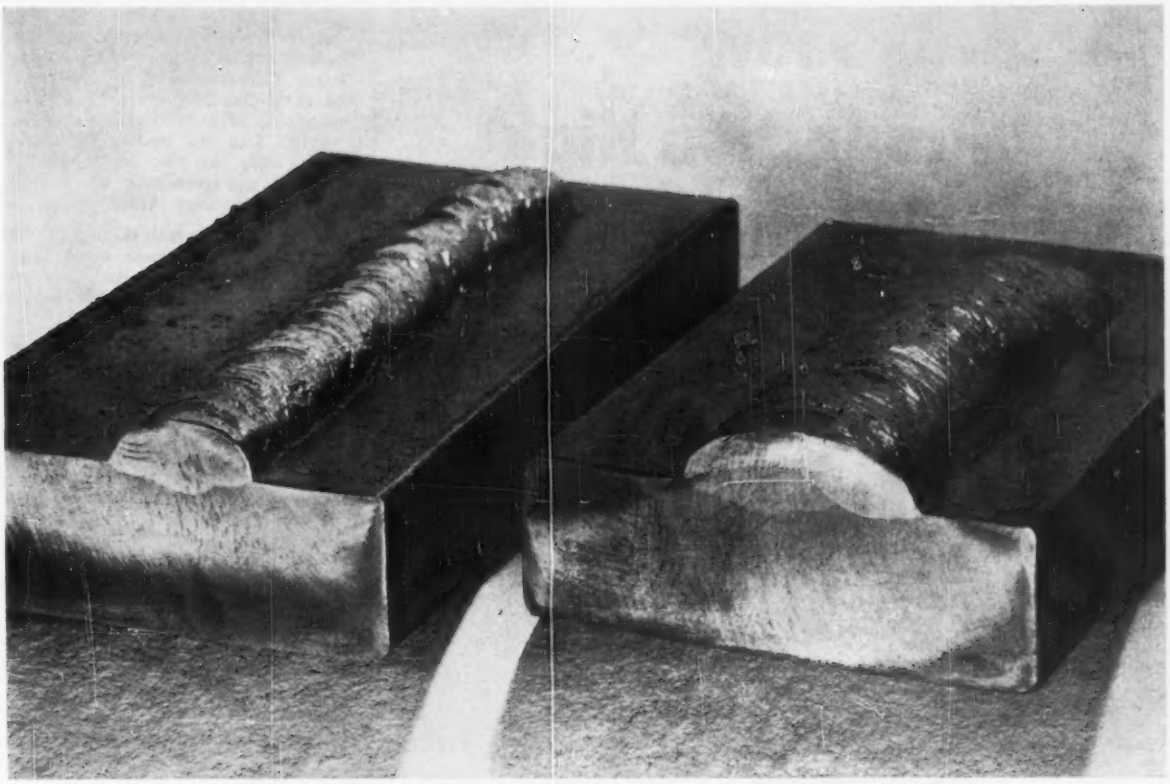
MINNESOTA

The employees of M. A. Hanna Co.'s Mississippi group of mines worked 628,549 man-hours without a lost time accident in 1957, winning the "Sentinels of Safety" trophy. One hundred open pit mines entered the contest sponsored by the Bureau of Mines. Of these, 43 had perfect safety records, but the Mississippi group had the largest number of man-hours worked. The trophy was presented on Oct. 3 to a group of over 500 employes, officials—local and from the Cleveland office—and representatives of the Bureau of Mines. George A. Borgeson, manager of safety and claims, acted as chairman of the meeting.

During the past two years, valuations of Chisholm City have dropped about $4-million. This problem of decreasing valuations has become a very serious one in some range communities. It is one that eventually must affect all of them as the ore within their limits is gradually shipped.

The Lake Superior Mines Safety Council met in Grand Rapids Nov. 6. D. G. Rukavina, Coleraine, safety supervisor for Oliver Iron Mining Division in the Canisteo district, headed the program committee. Principal talk was given by James Unger, Duluth, assistant to the supervisor of industrial relations for Pickands, Mather & Co., on a psychological approach to "The Foreman and Safety": a new and interesting angle to an old problem. A discussion on shop safety was led by Orton P. Jones, Hoyt Lakes, general shop foreman for Erie Mining Co. A paper and demonstration by Thomas O. Olsen, supervisor of training in the Canisteo district for Oliver Mining, was given on the topic "Stop It, Lock It, Test It." The U.S. Bureau of Mines, Duluth, discussed "The Magic of Fire" and showed a film, "My Pop's a Lineman." The meeting was well attended.

Juan Reccius, Santiago, Chile, director of the mines and fuel department of the Chilean ministry of mining and president of the Institute of Geological Investigations, spent a week visiting mines of Minnesota. His chief objective was to study safety organization and report to his government how a safety inspection program may be developed. He said that "we don't have enough engineers in Chile to supervise a mine safety program. Our coal mines are the only operations that have safety programs. Chile has hundreds and hun-



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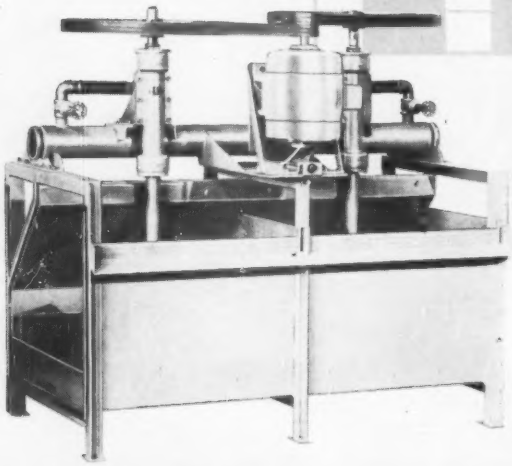

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Minnesota *(Continued)*

dreds of small underground metal mines, worked by five to twenty men, that operate without safety programs." About 18,000 Chileans work in coal mines and more than 25,000 are employed in the mining of metals including copper, iron ore, lead and zinc in addition to oil, he said. His visit to this country was under the sponsorship of the International Cooperation Administration.

At a public hearing held in Buhl Oct. 16, and called by Minnesota Conservation Commissioner George Selke, the Oliver Iron Mining Division filed a petition to deposit iron ore tailings in Three Mile lake, about three miles south of Buhl. The company would also change the channel of Buhl Creek in the vicinity of the lake.

Pittsburgh Steamship Co. Division of U.S. Steel Corp. laid up 10 ore boats at the Duluth and Superior harbors in October. Other ore carriers of the Steamship Division continued to operate through the week of November 16th. The division this year has operated only 37 of its 57 ships while all were in operation last year. Other companies, including PM&Co., also laid up some ore boats in October.

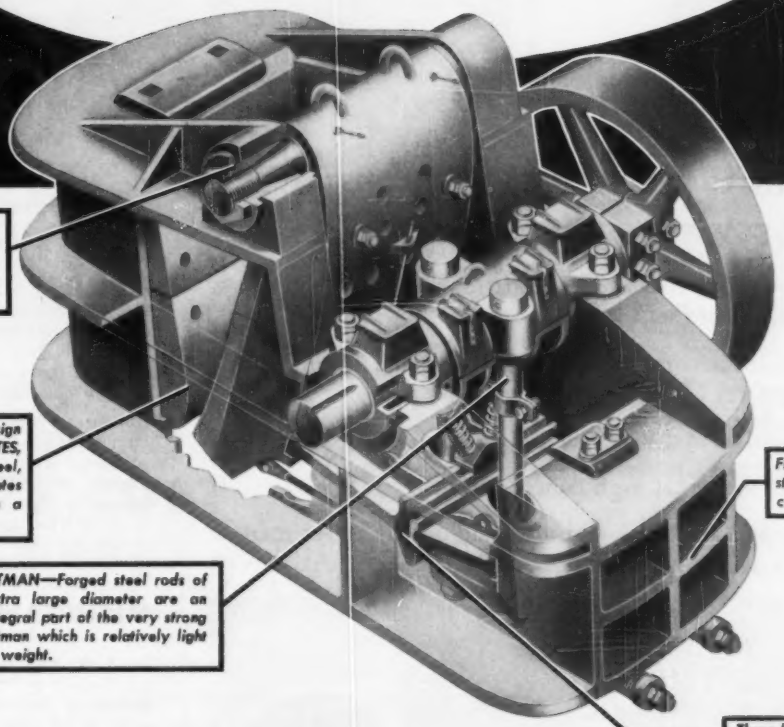
Following a U.S. Supreme Court decision Oct. 13 refusing to review the Rabbit Lake watercourse case, Attorney General Miles Lord announced that three other cases now pending will be carried on. He will endeavor to prove state ownership of iron ore deposits underlying certain northern Minnesota lakes. The Attorney General said the case decided applies to only one group of lakes and "this by no means ends my efforts to keep for the people of Minnesota these vast fortunes in mineral wealth."

Minnesota is preparing to sell leases on some 120,000 acres in St. Louis, Cook and Lake Counties where deposits of low grade nickel and copper ores have been located. Governor Freeman has announced that at least three mining firms are expected to be in on the bidding before the first of the year.

State Tax Commissioner, Joseph M. Robertson, has fixed the assessed valuation of unmined Minnesota ore, as equalized by the tax department, at $134,619,278, as of May 1, 1958. Of this amount $120,157,359 is for estimated ore in St. Louis County. On May 1, 1957, the corresponding figures were $140,327,670 and $124,347,605. The 1958 figures were based on 74,564,794 tons of unmined ore as of May 1. For 1957 there was an estimated tonnage of 761,312,626 tons—a difference of 86,747,832 tons, indicating some adjustments beyond the ore actually shipped. Oliver Iron Mining Division and some other mining companies have entered protests as to valuations placed on some of their properties. These have been taken under advisement by the tax commission.

The eighth annual M. A. Hanna Co. dinner for the "old timers" was held in

Traylor-MADE HB JAW CRUSHER



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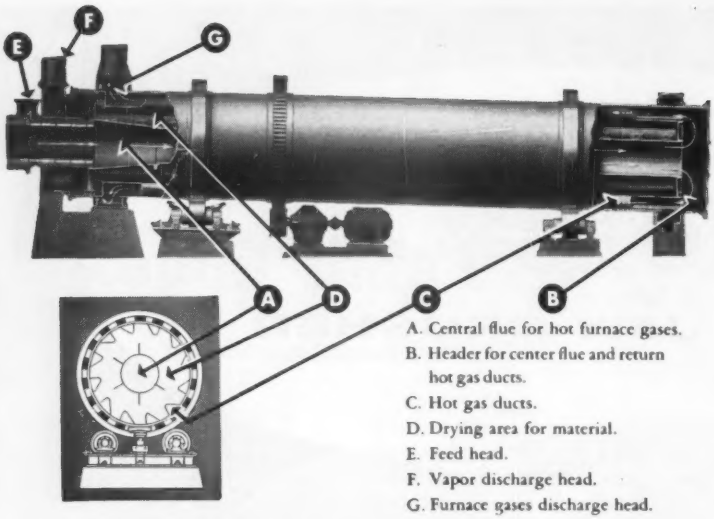

A. Central flue for hot furnace gases.
B. Header for center flue and return hot gas ducts.
C. Hot gas ducts.
D. Drying area for material.
E. Feed head.
F. Vapor discharge head.
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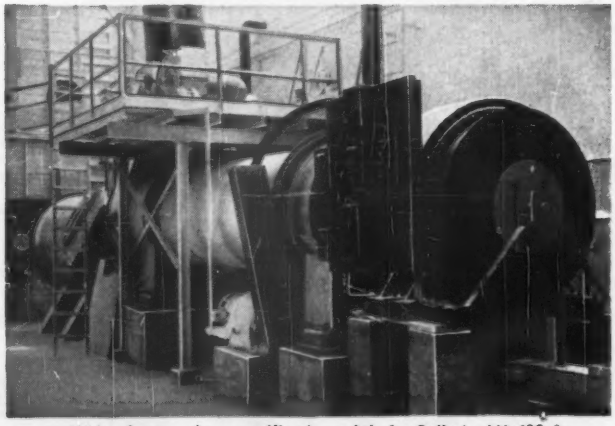

Ruggles-Coles Indirect Heat Dryer handling 200 mesh talc.

Write for complete specifications. Ask for Bulletin AH-438-1.

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Minnesota *(Continued)*

Hibbing Oct. 29. with R. W. Whitney, vice-president of the Hanna Coal and Ore Co. as the speaker of the evening. Among those honored was one employee with 50 years of service who received a $500 savings bond; one with 45 years received a $100 savings bond; eleven 35-year men received gold cigaret lighters and many others were given service pins and certificates. Similar dinners to honor employes with long service records have been held at Crosby, Minn., Iron River and Iron Mountain, Mo.

At a Cleveland-Cliffs Iron Co. awards dinner held in Hibbing, Oct. 1, Walter A. Sterling, president and chairman of the board of the company, told the employes present: "We feel that, while 1959 may not show much improvement, 1960 should be very much better." As to the future, he added: "Steel producers, in an effort to show better earnings on a reduced operating basis, are demanding higher grade ore. Such ores can only come from foreign sources and from taconite and jasper processes. As a result, foreign ores and high grade ore pellets and sinter are displacing large tonnages of standard ore such as the iron ore industry has provided heretofore. In the meantime we are spending large sums of money to improve the grade of our present standard ores and on metallurgical work in the production of high grade pellets from our jasper and taconite properties."

Iron ore shipments on the Great Lakes for September 1958, were 8,705,886 tons compared with 11,828,076 tons in September of 1957. Shipments for the season to Oct. 1 were 39,783,517 tons vs. 69,423,900 tons last year—a drop of 29,640,383 tons.

MICHIGAN-WISCONSIN

Dr. J. R. Van Pelt, president of Michigan College of Mining & Technology at Houghton, has announced the appointment of an advisory committee to the $750,000 Institute of Mineral Research of the college. The committee will assist the Institute to coordinate its research work to meet both present and future needs of mines and industries. One of the first problems will be to devise a method for beneficiation of Michigan's 2-billion tons of non-magnetic, low grade iron ore bearing formations. The committee consists of twelve of Michigan's leading mining and allied industrial organizations.

The report of county mine inspector, William C. Melchiori, for the year ended Aug. 31, 1958, showed total shipments of Iron County mines of 4,033,436 tons compared to 3,780,304 tons in 1957. Tons in stock for each year was about 600,000. Total number of men employed, however, was 669 less than in 1957, decreasing to 1,214. The only mine reporting an increase in employment was the Cannon of the M. A. Hanna Co. which gained 29 men. Although fatal accidents were higher

CF&I Expansion Type Rock Bolt—with Pattin Type D-1 expansion shell . . . for 1⅜" holes . . . with right or left hand threads (to allow tightening by left-hand rotation of drilling machines). Also available, the Pattin D-5 shell for use with ¾" and ⅞" bolts in holes of 1⅜" diameter . . . and CF&I Slot-And-Wedge Type Rock Bolts.

stronger, safer, space-saving support... AT LESS COST

strength—when anchored in mine roofs or walls, CF&I Rock Bolts provide maximum resistance to load with a minimum of displacement. Pattin expansion shells double the usual shell expansion, grip twice as hard.

safety—high strength steel, (to American Standard Specifications for Roof Bolting Materials sponsored by American Mining Congress), provides ample factor of safety...fully safety-tested...proven in use throughout widespread applications... CF&I Rock Bolts eliminate the danger of timbers bending or buckling under load.

space-saving—cumbersome, space-consuming timbering methods may be unnecessary. CF&I Rock Bolts permit maximum utilization of available work space and ventilation facilities.

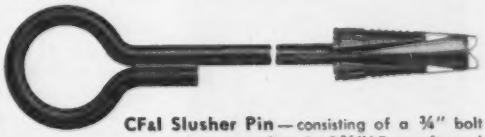
cost-saving—less bulky, easier to haul and install than heavy timbers. When used with Realock Metallic Fabric for lagging, CF&I Rock Bolts offer proved initial-cost savings up to 35% over timber sets.

OTHER CF&I PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Balls • CF&I Grinding Rods • Wickwire Rope • Mine Rail and Accessories • CF&I Industrial Screens • Realock Metallic Fabric

***ALSO,* for your convenience,**
CF&I SLUSHER PINS

When you make your own slusher pins, the cost may be high and you may not get the best possible results. As a customer service, CF&I makes available Slusher Pins made to the same high standards of quality, performance and minimum cost as our Expansion Type Rock Bolts. Modified CF&I Rock Bolts also make excellent hangers for such equipment as air and water pipe, electrical cable, vent tubes and ventilating fans.



CF&I Slusher Pin—consisting of a ¾" bolt threaded at one end, and a 2¾" I.D. eye formed and welded on the other end. These are anchored in 1⅜" diameter holes by means of Pattin Type D-1 expansion shells, and successfully withstand the pull from slusher drums.

A 20-min. Rock Bolting color movie "Make Mine Safety" is available for showing, through the offices listed below.

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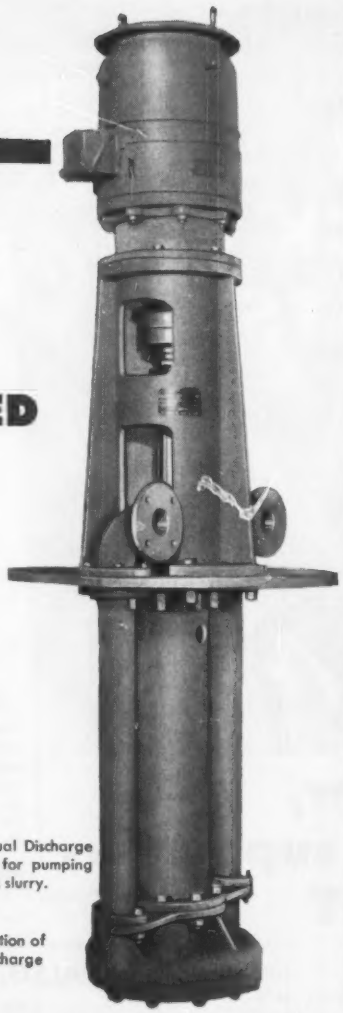
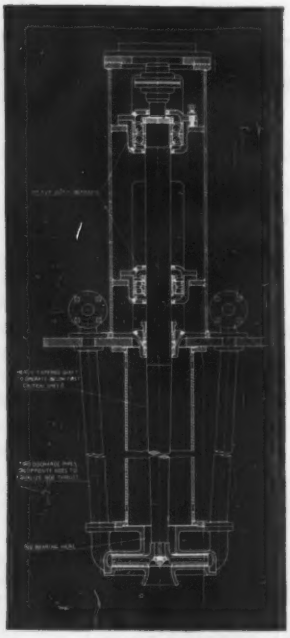


2" Dual Discharge Pump for pumping caustic slurry.



Cross section of Dual Discharge Pump.

This rugged type of service calls for advanced design: — extra heavy shaft, double-ported casing to equalize the side thrust of the impeller, and tough abrasion-corrosion resistant alloys. The dual discharge pump illustrated here incorporates these features and dispenses with bearings or packing below the cover plate where they would be in contact with the liquid.

Difficult pumping problems, particularly in the process industries, have been our specialty for ninety-one years. Perhaps we can be of help to you. Write us — no obligation.

LAWRENCE PUMPS INC.

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Mich.-Wis. *(Continued)*

(four), lost time accidents decreased materially. The report stated: "The beneficiation of low grade ore is well out of the experimental stage and for the past several years it has proven to be commercially sound and practical. This development will have a far reaching effect upon the mining industry in the states of Minnesota, Michigan and Wisconsin."

The annual M. A. Hanna Co. dinner for "old timers" was held in Iron River on Oct. 30 with about 360 men attending. The main speaker was Richard Whitney, Cleveland, vice president of the Hanna Coal and Ore Co. The men with long years of service with the company received special tokens while others were given certificates of employment.

M. A. Hanna Co. mining operations in the Iron River district returned to a five-day week Oct. 6. They had been on a four-day week for nine months. The Homer, Wauseca, Hiawatha and Cannon mines, employing nearly 1,000 men, were affected.

Among the projects approved by the Army's Engineer Board of Rivers and Harbors is one to deepen the Ashland, Wis. harbor to provide the greater depth which the St. Lawrence Seaway is expected to make necessary.

The Water Resources Committee of the Wisconsin Legislative Council voted to recommend changing the surface water permit law to include mining as well as agriculture. This would open the way for the taconite mining operations to apply to the State Public Service Commission for permission to use surface water. The matter of laws to permit changing the course of a stream was not acted upon. The first area of taconite to be mined is expected to be near Butternut in Ashland County.

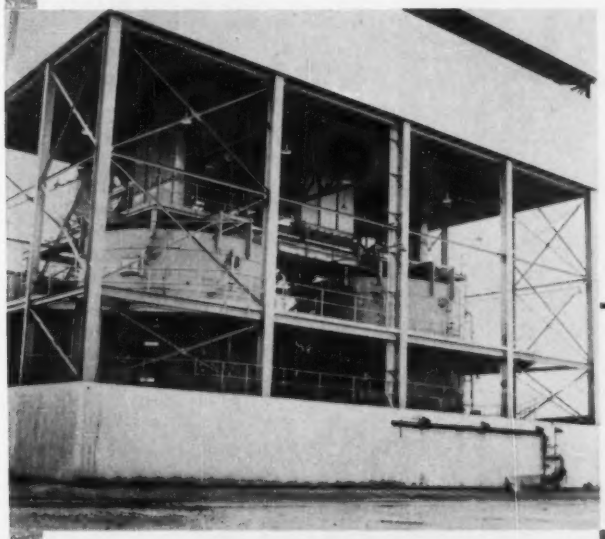
North Range Mining Co. has announced its decision to close the Warner mine at Amasa permanently. The mine suspended operations May 1, but it was hoped then that it might be reopened when conditions improved. Robert Archibald, Negaunee, executive vice president said "We have now determined that, because of the general market conditions for iron ore, high labor costs, high tax costs, and other costs we are forced to close the mine permanently." North Range also has the Book mine at Alpha. Though closed, pumping and repairs are being continued.

The Quincy Mining Co. reclamation plant, which has been closed for nearly one year, is being overhauled to have it in condition for reopening.

The 1957 report of Henry L. Scarffe, Ishpeming, Marquette county mine inspector, shows a total production from the county's 14 active mines of 6,560,-040 tons. Of this, Cleveland-Cliffs Iron Co.'s nine mines produced 5,381,351 tons or 82.64%. The Mather "A" and "B" shafts accounted for 2,646,700 tons or nearly one half of Cliff's production. Jones & Laughlin was second with its

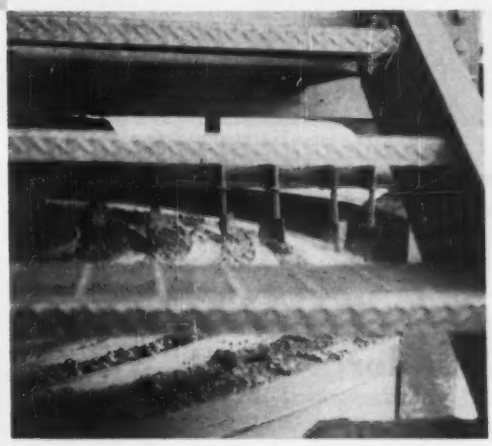
38 years of proved performance...

Skinner Furnaces



Installation in a southwestern U. S. copper company. Two 23'-6" I. D. 4-hearth Skinner Dryers. Each unit is drying over 20 tons per hour of copper sulphide concentrates from approximately 15% moisture content.

Looking into upper hearth, showing rabble arms raking concentrates into the next drying hearth.



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Mich.-Wis. *(Continued)*

new and developing Tracy mine producing 522,886 tons. Inland Steel with two mines, North Range and Pickands, Mather & Co. with one mine each, followed in that order. Cleveland-Cliffs at its Republic, Tilden and Humboldt open pits, produced 808,227 tons. The balance came from underground mines. About 3,250 men were employed at the mines during the year. There were three fatal accidents.

MISSOURI

Shaft sinking at the Meramec Mining Co. Pea Ridge site is down past the 930-ft level, with expectations that 1,000 ft will be reached before year-end. A second shaft is begun and is now awaiting a headframe for regular sinking. Both drives will eventually bottom out at 3,000 ft.

NO. 1 SHAFT at Pea Ridge deposit is now below 930 ft. Arrival at the 1,000 level is expected Dec. 31.

At the 1680 level a large pocket will be excavated into the 63% orebody. Sinking of Shaft No. 1 was hampered by 275 psi water flow at the 930 level. Full production from Meramec (a 50-50 Bethlehem Steel and St. Joseph Lead operation) is due in 1962. Bethlehem will assume main responsibility for the pelletizing process plant at the mine head.

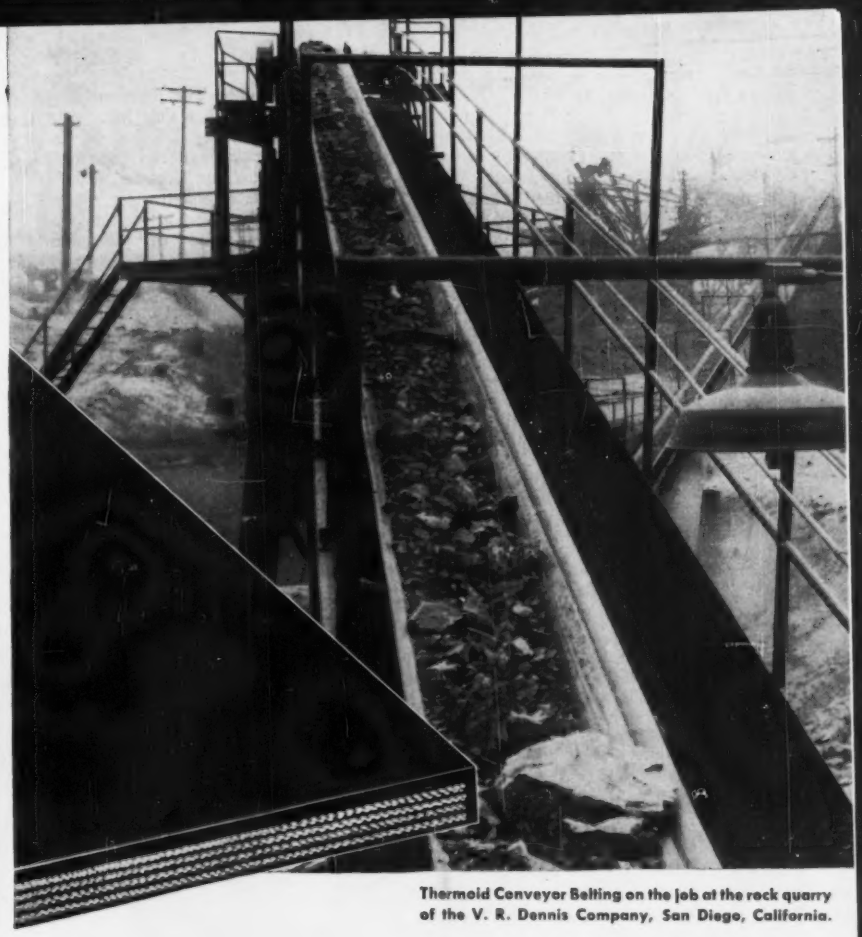
Current estimates of the size of the orebody set it at about 100-million tons.

MONTANA

Anaconda's Anselmo mine, a Butte zinc producer, was to resume operations on Oct. 20 after being closed down for four months because of a breakdown in the smelter at Anaconda.

NEVADA

White Caps Mining Co. during October made a shipment of 22 tons of gold, cinnabar and antimony ore from the White Caps mine at Manhattan in Nye County. Shipment was made to a Los Angeles smelter. White Caps is now

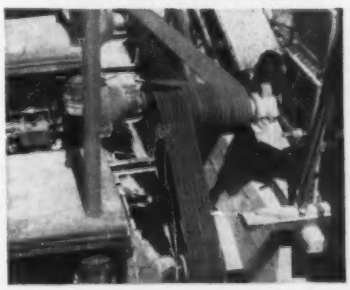


Thermoid Conveyor Belting on the job at the rock quarry of the V. R. Dennis Company, San Diego, California.

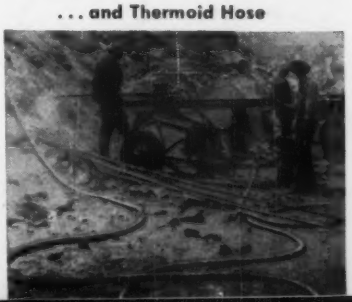
Belting that's Built to Take It!

Years of service on the toughest jobs have proved that Thermoid Conveyor Belting gives dependable service during its extra long life . . . cuts downtime to a minimum.

Cut costs with Thermoid Multi-V Belts . . .



. . . and Thermoid Hose



One big reason . . . superior construction: belt carcass and cover are welded into a single unit by Thermoid's exclusive impregnation process.

Another . . . top grade materials: Thermoid's specially woven, finest quality reinforcement enables Thermoid Conveyor Belting to trough easily, withstand shock loading as no ordinary belt can—yet it is flexible enough to avoid internal heat build-up.

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Nevada *(Continued)*

planning to erect a mill at the Manhattan site, and is also continuing work on the April Fool claim where important gold strike was made late in July while assessment work was being carried out. The April Fool mine is adjacent to the Manhattan post office, which hampers development. The shaft has been sunk to a depth of 35 ft and 55 tons of ore with a value of about $200 per ton have been removed.

Atomic Energy Commission has sent 5,500 lb of natural uranium to the Mackay School of Mines at the University of Nevada in Reno for use in nuclear experiments. The uranium is on loan from the AEC which last spring granted the University $40,000 to purchase a sub-critical reactor assembly. A room in Mackay Science Hall is being remodelled into a nuclear physics laboratory. Also on loan to the University are 80 grams of plutonium. Shipments were made from the Savannah River plant of the AEC.

Basic Inc. is constructing a new ore dressing plant at its Nevada plant near Gabbs. The project is part of a $1-million expansion program which the firm is carrying out. The facility will extend reserves and enable the company to manufacture magnesia products from natural ores that will be fully competitive with refractories from chemical processes. The Nevada works will be further enlarged to expand the production of caustic calcined magnesite to meet the increasing demands from the chemical industry.

Construction of Nevada's first uranium mill is now assured, according to officials of Apex Minerals Co. It will be constructed near Austin at a cost of $800,000, W. R. Noack, of La Canada, Calif., Apex president, says. The AEC has agreed to purchase the uranium concentrates produced by the firm from ore in the rich Apex mine. Custom ores will also be handled. The Apex mine has been Nevada's chief producer of uranium ore for the last few years, and has extensive ore bodies mapped out for future development. Construction of the mill will begin in the very near future, according to Noack. Up to now ore from the Austin area has been trucked to the nearest mill at Salt Lake City. The new mill will be the first of its kind west of Utah.

Western Silica Co., of Bakersfield, Calif., is making shipments of silica from its property at Cuprite, in Nye County. Production from the site is going to Ajax, Purex and Colgate-Palmolive companies in carload lots. The property was acquired by Western Silica Co. from Margie Guyott and Bill Peterson, of Tonopah, and considerable development work has been carried out. Production is going on at the rate of 100 tpd, under direction of Peterson, who is mine superintendent. I. M. Feldkamp Jr. is general manager of the firm.

Ohio Mining Co. at Goldpoint has added a second shift at its gold property, and has increased its production from 40 to 75 tpd. Ore is being shipped to the U.S. Milling and Minerals Corp. mill at Silver Peak. Discovery of a rich body of gold-silver ore at the 800-ft level of the mine was made during October, and A. W. Rischmiller, head of the firm, says it consists of high-grade gold and silver at a width of 10 ft. Values run from $140 to $200 per ton in the area. It is the best high-grade stringer ever located in the mine, and a raise has been started from the 800 to the 600-ft level to see if it is a continuation of the vein.

Mesa Petroleum Corp., of Bartlesville, Okla., has announced plans to construct a mill for recovery of selenium and silver from the Tonopah ores in Nye County. The deal was made in cooperation with Vic L. Smith, Tonopah mining man. Tailings from the old Tonapah-Belmont mill will be processed as well as surface dump material. Extensive samplings have proved the dumps have good values in selenium as well as a small amount of recoverable silver. Nevada Minerals & Oil Corp., headed by John W. Darr, of New York City, will be in charge of Nevada operations for Mesa Petroleum Corp. William J. Crowell, of Carson City, has been retained as legal counsel for the corporation.

FLASH!
A newly developed Bemis explosives bag is now being tested. The bag has kept contents perfectly dry even though submerged in a mine pond for days. Write or wire for details.

Packer-Ette at United Electric Coal Company's Fidelity Mine packing Bemis-made waterproof (laminated) bags. Packer-Ette is equally efficient in packing polyethylene bags or tin cans.

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Packs Ammonium Nitrate Explosive With Greater Speed, Economy, Accuracy, Cleanliness

- **50 percent increase in production**
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These five major benefits were reported by United Electric Coal Company when it began packing its formulation of ammonium nitrate explosive on a Bemis Packer-Ette bag packing machine.

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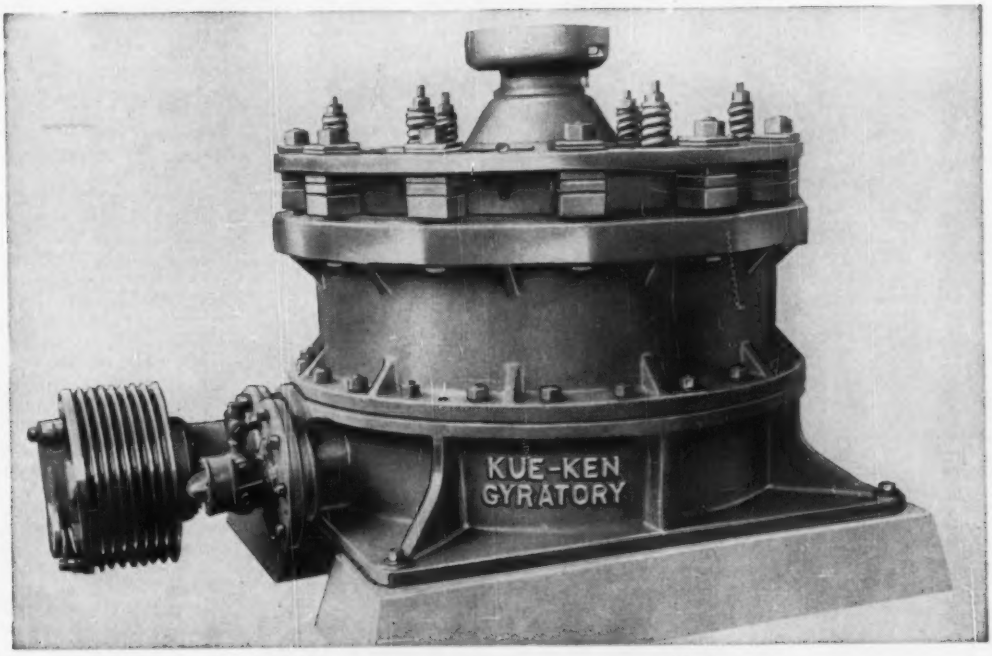

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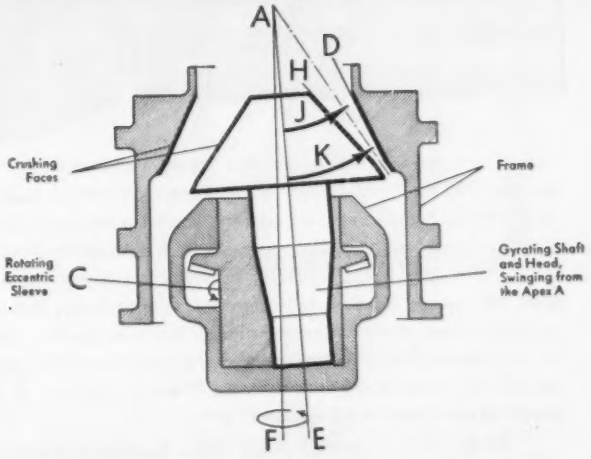
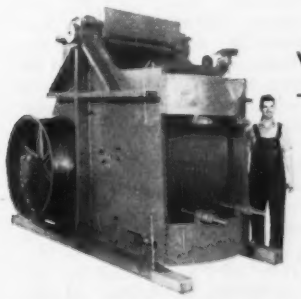


See how Kue-Ken crushing faces pass through crushing zone on arcs J and K to crush rock squarely without rubbing liners.



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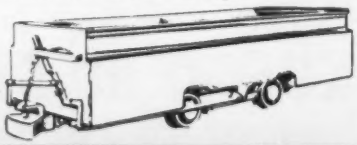
Trains are long; haulage distances constantly increase; grades grow steeper. To keep in full operation economically, the cars have to be easy rolling, strong of frame, and solidly built against mild corrosion. All wheels are Timken bearing equipped and live rubber pads are used instead of conventional steel springs. They are 152 cu. ft. in capacity, struck measure, and track gauge is 42".

Aside from a heavier draft gear to meet the requirements of steeper grades and heavier trains, today's cars are little changed from those in the original order. Four re-orders over a period of years prove customer satisfaction at International Minerals & Chemical Corp.

You, too, can customize your haulage with an economical CARD design. Our engineers can furnish an efficient car to meet your most difficult specifications.



C.S. Card Iron Works Co.

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DENVER, COLORADO

NEW MEXICO

An expansion of mill'ng in the Ambrosia Lake district is being sought by Phillips Petroleum Co. and Quinta Corp., headed by Victor Salazar of Albuquerque.

Negotiations are now underway with the Grand Junction Operations Office of the AEC for a substantial added ore run and contract re-arrangement affecting Phillips' mill in the district. The negotiations are being watched with an attentive eye by other operators in the Ambrosia area.

AEC has found, previously, that no major expansions of milling were required in this district—on basis of ore reserves and contracted mill expansion as of Nov. 1, 1957. The survey resulted in a limited expansion plan for milling in other domestic uranium districts.

Both Phillips and Quinta assert that some 1-million tons of uranium ore in Township 16, Ranges 16 and 17 West were, in effect, "overlooked" in connection with the Commission's reserve-milling survey.

Added run of ore is being sought in connection with firming up the Phillips' contract through to Dec. 31, 1966, *E&MJ* was informed.

A portion of the ore deposits, validated by close drilling from the surface, are on Indian lands. Phillips and Quinta share interests in the reserves, which would have to be mined on underground basis.

An early decision is expected on the negotiations, according to informed sources.

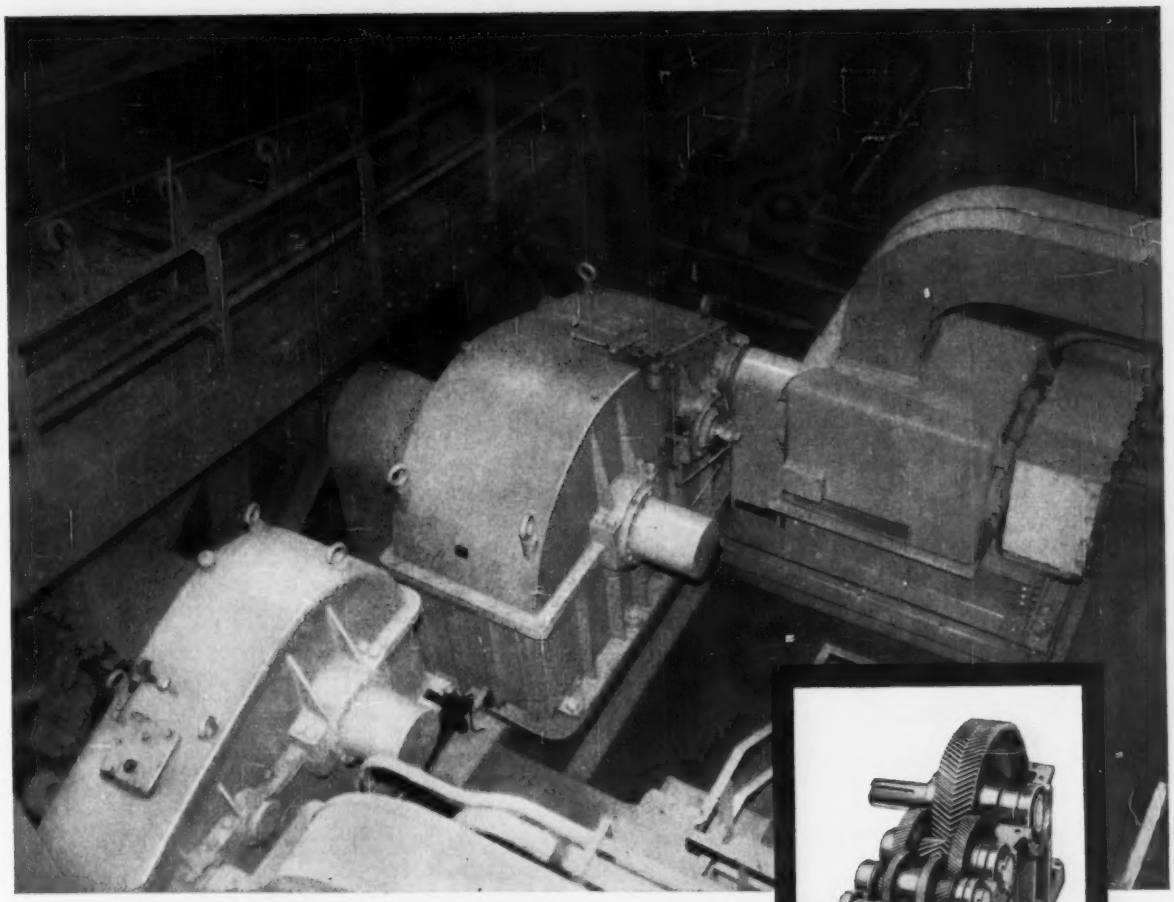
AEC has received assurance from the Carlsbad potash producers "of cooperation in the conduct of a planned small yield underground nuclear detonation" sometime in the future. The Commission noted that it might not take place until after the expiration of current negotiations in Geneva on the halting of nuclear tests, and would be conditional upon the decisions (if any) reached there.

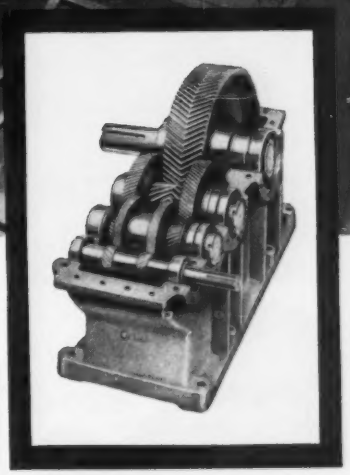
Potash industry spokesmen will recommend sites for the proposed tests, on the basis of criteria furnished by AEC calling for purity of salt formations at a reasonable depth and a location on public lands.

James E. Reeves is manager for the designated Project Gnome.

Drs. Roland Beers, Rensselaer Polytechnic Institute, Troy, N. Y., and George Maxey, Illinois Geological Survey, Urbana, Ill.; and members of the AEC technical staff and the University of California Radiation Laboratory were to meet with representatives of the potash industry Nov. 21 at Carlsbad to consider questions the industry has raised about possible shock effects of a 10-kiloton detonation on their final production areas.

Drs. Beers and Maxey are members of a special panel of consultants to Mr. Reeves. They were designated by the National Academy of Science as authorities on seismic and ground water problems to advise Mr. Reeves on the safety aspects of underground nuclear





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New Mexico *(Continued)*

detonations. With two other associates, Drs. David Griggs, University of California at Los Angeles, and Perry Byerly, University of California, Berkeley, they agreed that preliminary data assured that the proposed experimental shot could be conducted without damage to any existing or potential mining areas.

OREGON

Werdenhoff Mining Co. expected to begin producing mercury about Dec. 1 at its newly-discovered cinnabar deposits near Prineville, according to Richard and Frank Ruffo and Stan Sepic, principals. Roasting furnaces have been ordered.

Next spring, the company expects to start up a new mill with a capacity of 240-tpd ore. A mill with a capacity of 50 tpd is scheduled for erection next summer to produce garnet while a plant also will be built at Tacoma to make industrial abrasives, including garnet sandpaper.

TEXAS

The Bureau of Economic Geology of the University of Texas has just completed a study of the mineral resources of the Colorado River Industrial Development Association area—10 counties along the Colorado River from central Texas to the Gulf of Mexico. The report, by John W. Dietrich and John T. Lonsdale will discuss deposits of such commodities as: bleaching and burning clays, building stone, cement and lime materials, chemical limestone and dolomite, feldspar, graphite, grinding pebbles and mill liners, lignite, magnesite, phosphate rock, rare earth minerals, salt and sulphur, sand and gravel, shell, soapstone, as well as vermiculite, and volcanic ash. The report on the CRIDA area will be issued by the University of Texas as Bureau of Economic Geology Report of Investigations No. 37.

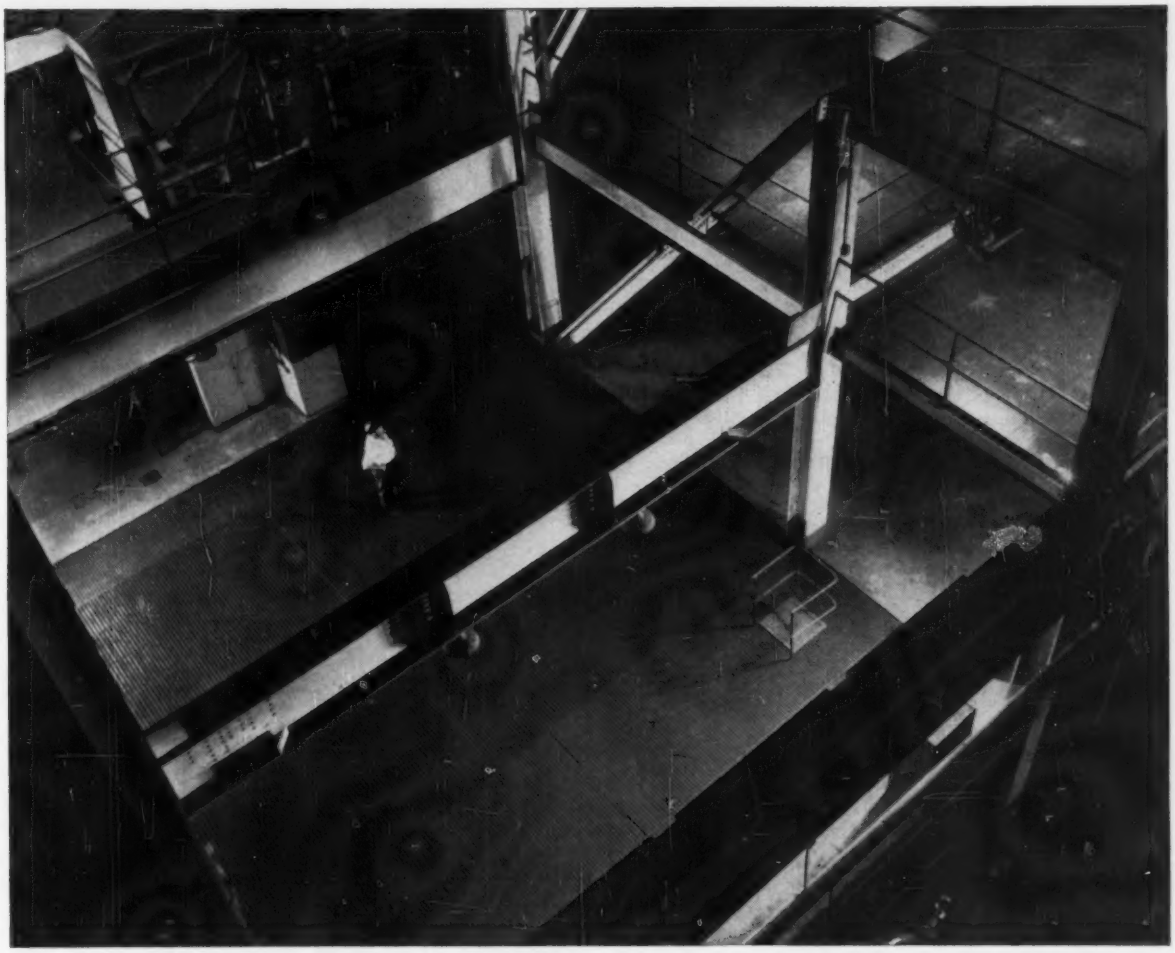
Industrial Minerals, Inc. of Austin, is currently developing a new talc deposit in the Hudspeth County talc district of Trans-Pecos, Texas (*E&MJ*, January 1958). Located in section 18, the orebody appears to contain very large reserves of high grade ceramic talc.

UTAH

Standard Uranium Corp. has now raised gross value of its new ore reserve in its Big Buck mine in San Juan County to more than $12-million.

W. R. McCormick, president, Moab, said in a letter to shareholders that the firm had to date blocked out 375,000 tons of ore in drilling operations started Oct. 1 and still continuing on the Big Buck 11-A and Big Buck No. 12 claims.

"Although drilling is still in progress



Blaw-Knox Electroforged® Steel Grating provides removable floors to simplify plant operation

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Blaw-Knox Electroforged Steel Grating for walkways, stair treads and floors is fabricated to meet your specific operating needs. For new ideas about a complete line of space saving grating, write for Bulletin 2527 featuring grating and treads.

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Equipment Division
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Basic kit includes drill, pump, and accessories. Rods and bits additional.

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This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

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Utah *(Continued)*

in this area, sufficient information has been obtained to give an accurate picture of the orebody," he said.

"Present indications are that the highly mineralized area extends for a length of approximately 1,000 ft and a width of 400 ft with thickness (of orebody) ranging from six feet to 42 ft with an average (thickness) of 20 ft," McCormick said.

"Values range from six feet of 0.16% U_3O_8 in one fringe hole to 42 ft of 0.75% U_3O_8 for one of the central holes," he said.

Mr. McCormick said the Standard orebody is "an extension of the Standard-Cal-U-Mex orebody that has been mined by Standard Uranium for the past year. This extension is almost entirely upon ground wholly-owned or controlled by Standard," he reported.

The Moab resident said that Standard "did not have any" marketing problem at present and does not anticipate having any difficulty in selling its ore.

"This orebody is merely an extension of previously known ore and as such does not fall into the classification. (imposed by the Atomic Energy Commission) of a new orebody," he said. "In addition, the ore is of a premium grade, being both rich in uranium and very low in lime content."

Mr. McCormick estimated that "nearly five years will be required to work out the new ore body at present mining rates." Full-scale mining operations are presently being conducted on one edge of the orebody, he noted.

It's State Senator Charles A. Steen. The founder of the Mi Vida uranium mine in the Big Indian district of San Juan County, which discovery set off the domestic A-ore boom, was elected as a Republican member of the Utah Senate Nov. 4.

Steen's home area—Grand County—gave their most famous resident a plurality of 3:1—sufficient to offset his Democratic opponent's strength in two other counties.

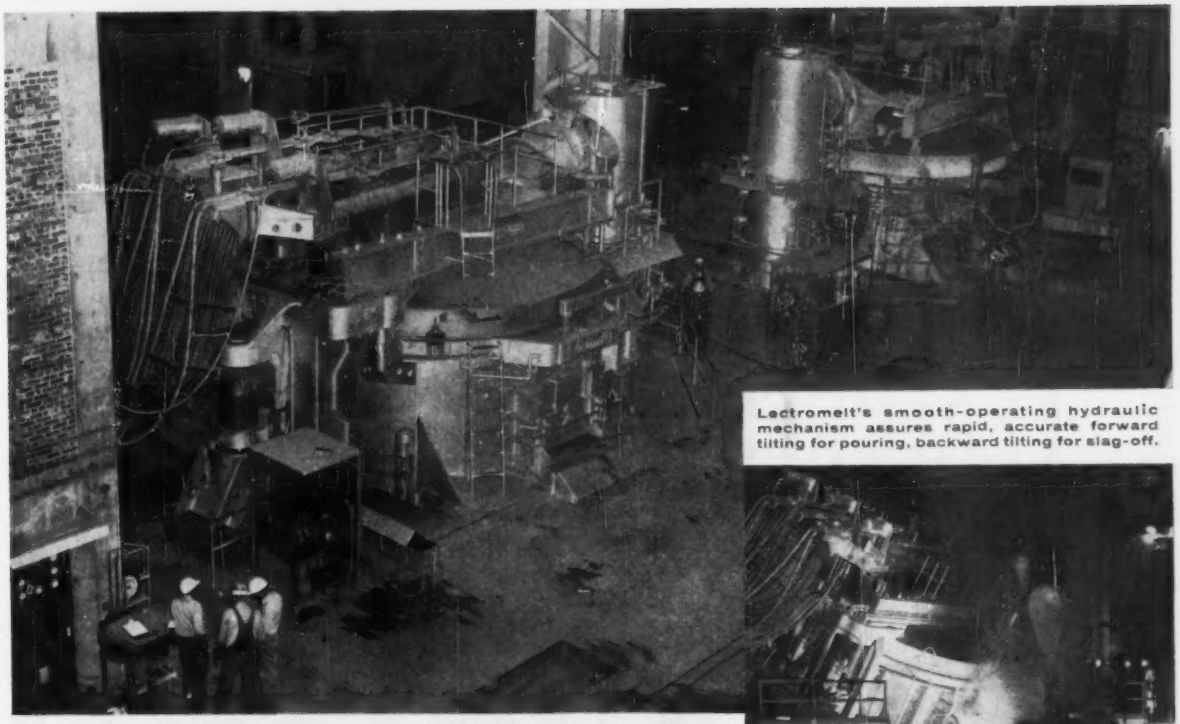
Steen's election also assured the GOP of a one vote margin in the State Senate. Republicans lost control of the House.

Mining men interested in community relations have for years struggled to come up with a measurable figure on what mining means in terms of wealth to local areas.

The big problem: (1) a great deal of mining has been established so long as to blur the outlines of any study; (2) other mining areas also contain manufacturing and business not related to raw materials production or processing. Thus job growth outside of mining, but possibly resulting from mineral development, cannot be pinpointed.

However, the uranium boom in isolated Grand and San Juan counties, Utah, has provided an excellent "test tube" for the industry.

In coordination with the Utah Mining Assn. and other agencies, the University of Utah's Bureau of Economic and Business Research headed by Dr.



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Now, a heat takes 4½ hours or less from the time the first scrap steel is placed in the furnace until the molten steel is ready to pour. Each Lectromelt furnace produces an average of 25 tons of ingots per hour. Capacity of the plant has been boosted from 246,000 to an estimated 420,000 ingot tons per year.

Top-charging Lectromelt furnaces are increasing metal-producing capacity all over the world. Users report higher tonnage per man-hour, lower power consumption, savings in electrodes and refractories. Precise control possible with Lectromelt furnaces contributes to greater uniformity and more accurate alloying of metals.

For complete technical data—ask for a copy of Catalog 10. Write Lectromelt Furnace Division, McGraw-Edison Company, 322 32nd Street, Pittsburgh 30, Pa.

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XRSB-1

Utah *(Continued)*

Osmond L. Harline took 1950 levels of employment, etc. in Grand and San Juan counties, weighed them against levels of 1957. It used similar indexes for three nearby agricultural counties—Wayne, Emery and Garfield—which were much like the two new mining counties before the uranium boom.

Result: For every 100 miners employed, 84 others in the mining community had jobs. But the impact is even wider. One uranium mining firm with a payroll of $1.1-million annually spends $4.3-million each year in purchases of supplies.

Of that amount, half the expenditures were in the mining counties; 30% additional was spent elsewhere in the state of Utah and the balance of the funds were expended in areas outside of the state.

By contrast, farm employment as well as population dropped some 10% in the non-mineral counties.

The report notes that in 1950 there were 19 mines employing some 198 persons in the two counties. By 1957, mine employment had hit 2,700 in 120 properties (mines and mills).

WYOMING

Northwest Oil & Mining Corp. has made its initial shipment of 200 tons of uranium ore from its recently-acquired Skyline mine in the North Gas Hills area of Fremont County.

R. J. Diefenderfer Jr. of Sheridan, Northwest president, said the inital shipment went to the western Nuclear mill.

Production at the Archer-Daniels-Midland Co. bentonite processing plant at Upton will be curtailed for an indeterminate period after a fire Oct. 24.

Carl Barritt, plant superintendent, said the drying and grinding section of the block-long plant was demolished by the fire. Barritt would not estimate the damage.

Cause of the fire was not known. The plant was a frame structure.

Fremont Minerals, Inc.'s new million dollar sulphuric acid manufacturing plant at Riverton was expected to go on stream early in December.

It will have a minimum capacity of 125 tons of acid a day.

The plant will be capable of supplying all the anticipated needs of acid for central Wyoming uranium mills.

The plant was constructed by Leonard Construction Co.

Fremont Minerals said it already has plans on the drawing board for expansion of the plant should additional markets for sulphuric acid develop in Wyoming.

The new plant is located near Fremont Minerals' uranium ore processing mill.

A 20% expansion of soda ash production at Intermountain Chemical Co.'s soda ash mine and plant 20 miles west of Green River has been announced by R. A. Bondurant, resident manager.

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IN CANADA

BRITISH COLUMBIA

Annual report of the British Columbia Department of Mines released by Mines Minister Kenneth Kiernan disclosed that mineral production in B.C. during 1957 was valued at $172,264,617. This represented a drop of nearly $18-million from the record production of $190,084,302 in 1956. Generally lower prices for "most of the principal metals" was given as the reason for the reduction, despite the fact that 1957 was only exceeded by 1956, 1955, and 1951, making it the fourth highest in B.C. history.

Establishment of a small steel industry in B.C. within five years, using about 250,000 tpy, is expected by Mines Minister Kenneth Kiernan.

But Prof. W. M. Armstrong, University of B.C. metallurgist, told the government mining conference in Victoria that the project is not economically feasible. For every ton of iron ore used in a local steel industry, two tons would have to be exported.

George Lipsey, general manager of Empire Development Co., criticized government policy of trying to protect iron ore reserves from export. Iron ore exploration and discovery have been hampered by "adverse legislation," he said.

Jericho Mines Ltd. reports samples assaying 20 to 56% copper with minor silver content from the Witches Brook section of its Highland Valley property. A road is being graded to ensure the continuance of winter work.

Hamlin B. Hatch, consulting geologist, claims that the discovery destroys the widely-held theory that the Highland Valley is a low-grade copper belt, and feels that selective mining and shipping of high-grade copper ore can be carried on profitably with comparatively small capital investment.

Granduc Mines, Ltd. has discontinued development of a copper mine prospect in northern British Columbia. For the past several years Granduc, owned by Granby Consolidated Mining, Smelting & Power Co. (38.6%), and Newmont Mining Corp. (41.2%), has been conducting diamond drilling and other exploration work at the Granduc properties.

A diamond drilling program has been started by Harbour Natural Resources Ltd. in the Cranbrook area with a view toward eventual establishment of a $1-million to $1.5-million mining and milling operation. Unit's anticipated production will be 70,000 tons of dead-burned magnesite per year.

The project may possibly serve to eliminate the need for Canadian magnesite imports from Yugoslavia.

QUEBEC

Bateman Bay Mining Co. is re-opening its copper property in the Chibougamau area. Following unwatering of the shaft, which was sunk to depth of 276 ft in previous work, approximately 1,000 ft of lateral work will be undertaken to explore the "A" zone on the 250-ft level. Extensive diamond drilling in this zone indicated 565,000 tons grading 1.8% copper, 0.115 oz gold and 0.47 oz silver per ton across average width of 9.7 ft to the 600-ft horizon.

Orchan Mines will continue its present diamond drilling program throughout the winter on its Mattagami area discovery group. Two drills are currently in operation in testing the zinc-copper sulphide replacement deposit. Other favorable anomalous areas on the property have yet to be tested.

The Iron Ore Co. of Canada has increased its stockpile capacity at Seven Islands from 1-million tons to 1.9-million tons.

Headed by the Little Long Lac organization, Malartic Gold Fields has undertaken a development program on the Malartic area gold property of Consolidated Marbenor Mines. The program will consist of sinking a 3-compartment shaft to 850 ft and the carrying out of a minimum of 3,000 ft of lateral work and 10,000 ft of underground diamond

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- **5. Simple, trouble-free operation.**

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Special equipment and specialized experience of INFILCO in the Hydrometallurgical field can be interpreted to meet your problems in chemical feeding, leaching, oxidation, carbonating, precipitation and continuous ion exchange. Your inquiry is invited.

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Pit-and-Plant Housekeeping needs doing every day!

Your clean-up tasks pay no direct profits. But if neglected, they can give you ore-grading troubles, increase hauling costs, add to equipment-maintenance, and cause downtime that cuts production. One man and a modern motor grader earn extra profits by doing necessary "housekeeping" chores day-by-day. This full time clean-up service costs no more than allowing conditions to get so bad you must handle them as emergency projects.

That is why you will find a modern L-W Adams† grader on a regular program of mine "housekeeping" will be a real money-saver for you. Here is a list of everyday assignments you should probably include among your "housekeeping" problems:

1. Haul-road maintenance... saves tire wear, speeds hauling, improves safety, lessens operator fatigue, cuts costs, increases profit.

2. Clean-up of pit floors... permits driving equipment by shortest route, saves wear on tires and crawlers, improves pit drainage, keeps dirt and refuse from weathering into lower levels of ore.

3. Clean-up after blast... the sooner scattered fragments from blast are moved back against toe, the safer for men, tires, and machines that move around your pit.

4. Clean ore-benches of washed-down dirt... the better your grade of ore, the better your price. Leaving silica and other washed-in debris on your benches invites it to wash into crevices and drill holes in your ore. Prompt grader-service stops "wash," piles material for easy removal.

5. Keep concentrating-plant area clean ... safe to work around... drive around. There is occasional spill over the sides of heaped trucks, around conveyors, grizzlies, hoppers, trestles. It pays to clean it up... daily.

6. Keep toes of stockpiles pushed in ... they contain valuable merchandise. Weather and loading operations tend to spread stockpiles, eat up valuable work-space, waste stored material. To load from thinly spread toe gives inferior grades, increases loading cost.

7. Keep drainage open... don't let puddles stand. Your pit area continually needs new drainage ditches. As old ditches fill, you need to clean them out.

8. Level dumps... so trucks can move in faster. An L-W Adams travels up to 27 mph... quickly gets up on the dump, cleans-up, and gets back to the pit... working the haul-road both ways.

9. Snow and ice removal... blade-grading... quickly cleans pit and plant roads for safe, fast hauling. If there are drifts to lick, a V-plow or Snow-Blo wing attachment on your L-W grader helps open blocked roads quickly.

10. Exploration work... a modern motor grader to build and maintain haul-roads is a "must." Once heavy clearing is out-of-the-way, an L-W Adams heavy-duty grader can build you a mile of well-graded-and-drained highway in a matter of hours.

It may be a good idea now to make a survey of your pit-and-plant "housekeeping." Check, too, your available graders... compare them with the workability and versatility of a modern L-W Adams. Perhaps it's time for a change? A new broom sweeps clean ... a new Adams could revitalize your "housekeeping" program! Write for more information. If you'd like reprints of this advertisement to use in discussing "housekeeping" with your staff, just tell us how many copies you need.

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POWER-Flow models are torque-converter equipped. Weights shown are with standard equipment.

Adams optional equipment includes bulldozer, Jebco Elegrader, scarifier, snow plow, and snow wing.

†Trademark G-1814-M-1

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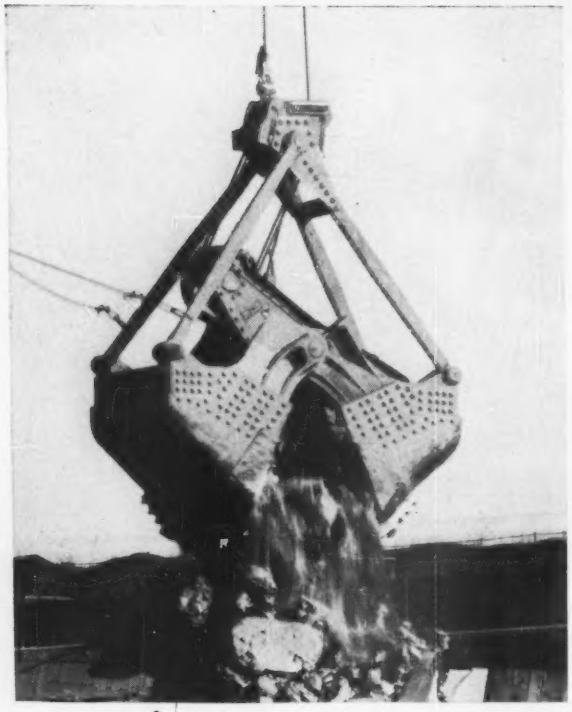

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Whether you are rehandling from barge, car leaching tanks or tailing pond or stockpiling at the mill or smelter, you can improve your rehandling operations with a Blaw-Knox two-line lever arm bucket, of the proper size and weight.

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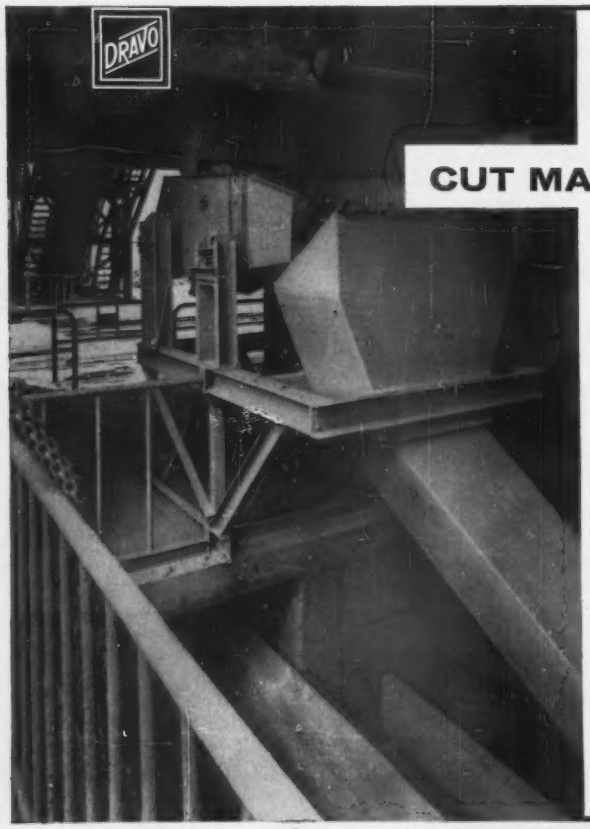

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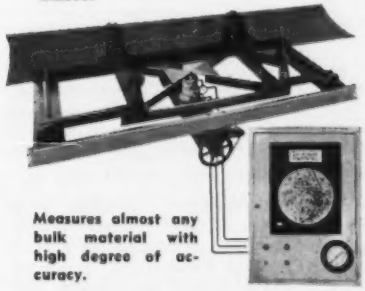

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Design prevents inaccurate torsional pressures, thus eliminating errors resulting from uneven belt loading.

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Quebec *(Continued)*

drilling. The company plans to treat the drill-indicated ore at the Malartic Gold Fields custom mill. The original diamond drilling, carried out some years ago, indicated three separate oreshoots. No ore estimate was made due to the erratic distribution of gold in the veins.

Diamond drilling by Consolidated Zinc Corp. of Canada on the Noranda district property of Consolidated Vauze Mines has added considerably to the size of what had been regarded as a possibly small but high grade lens. Known strike length has been extended upwards of 350 ft, and is still open to the east. Two zones have been indicated, the upper, considered to be limited in tonnage, and the lower or main zone, which holds promise of additional tonnage. In a series of holes put down recently, best results to date gave 22.7-ft intersection averaging 12.23% copper, 13.35% zinc, 0.04 oz gold and 4.08 oz silver in the upper zone and a 22-ft intersection averaging 13.03% copper and 5.98% zinc plus values in gold and silver in the main zone.

Kitchigama Syndicate has completed an arrangement with Noranda Mines for the financing of a thorough exploration program on its widespread holdings in the Mattagami area. The syndicate is composed of Dome Mines, Leitch Gold Mines, Area Mines, Iso Uranium, Highland-Bell and Teck-Hughes, the same group that formed the Mattagami Syndicate which discovered the lead-zinc-silver orebody at Watson Lake. This orebody is currently being developed by Noranda, McIntyre and Canadian Exploration. The Kitchigama holdings consist of 446 claims in seven groups located throughout the district. Geophysical work is being done on all groups with diamond drilling planned to follow up favorable areas.

ONTARIO

Ore shipments from Steep Rock Iron Mines at Steep Rock Lake have shown a consistent increase throughout the year. The 1958 total may top 1.25-million tons and it is expected that 1959 will be better. October shipments, the highest for any month so far this year, totalled 256,105 tons, against 227,196 tons in September and 205,126 tons in August. Total shipments in 1957 were 2,348,538 tons.

Campbell Red Lake Mines is turning out record production this year from its gold producing property in the Red Lake area. In the first nine months, production totalled $3,828,576 from 191,494 tons milled, up from $3,575,979 and 190,937 tons in the corresponding period of last year. Average recovery has shown a substantial gain, moving up from $18.73 to $19.99 per ton.

Stanrock Uranium Mines is now operating at a near capacity treatment rate at its 3,000 tpd plant in the Elliot Lake district. The mill started on March

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Ontario *(Continued)*

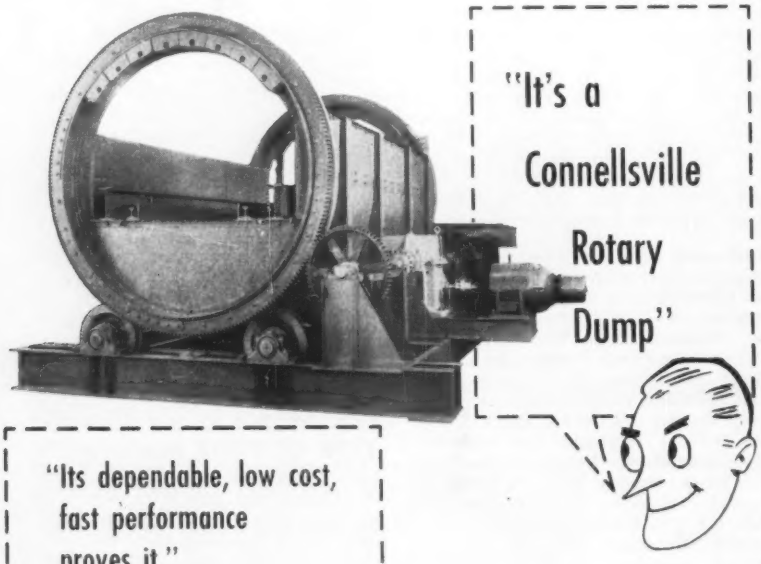
1, 1958. Mill heads have been averaging 1.66 lb uranium oxide per ton with recovery being maintained at about 92%. The company has a contract with Eldorado Mining and Refining for sale of $95-million worth of uranium oxide to March 31, 1963, with option covering further period to March 31, 1966.

The Abe Mathews Engineering Co., Hibbing, has opened an office in Port Arthur, Canada; A. W. Mathews of Canada, Ltd. The company in prominent in the design of iron ore beneficiation plants.

Two Ontario gold producers, MacLeod-Cockshutt Gold Mines (60%) and Kerr-Addison Gold Mines (40%) have taken up a 74-claim copper prospect in the Little Long Lac area. Strong anomalies were first indicated by an aerial electromagnetic survey and these were subsequently confirmed by ground geophysical surveys. Prospect drilling has disclosed extensive gossan areas under the anomalies. A program of heavy diamond drilling, possibly up to 15,000 ft. is scheduled.

Production of Lake Shore Mines, showed an increase of 12% in the first nine months of this year compared with the corresponding period of 1957. Output amounted to $1,799,197 from 141,870 tons milled, against $1,606,349 from 134,367 tons in the first nine months of last year. Recovery for the 1958 period was $12.68 per ton, up from $11.95.

The reconstructed and improved jig plant of Canadian Charleson, Ltd. which was moved from Virginia, Minn. to Canada near Steep Rock and Antikokan, shipped its first ore in early October. The new property adjoins Steep Rock on the south. It has a substantial tonnage of gravel, containing about 15% of iron ore from which the company expects to obtain about 10% recovery. While this is low by Mesabi range standards, the mining is relatively low in cost since it is handled by 24 cubic ft scraper loaders with a haul of approximately one half mile to the plant.



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SASKATCHEWAN

A large scale drilling program got under way in early November in an attempt to outline a substantial iron ore deposit in central Saskatchewan. Kelsey Lake Development Co. announced that it is spending $200,000 on a preliminary four hole program south of the village of Choiceland.

Using an oil drilling rig, the company is putting holes into the Precambrian to a depth of 2,000 ft. Once casing has been cemented to the bedrock, a heavy diamond drill will take over to go down another 1,000 ft.

Kelsey has a work-purchase option on the 105 claims from Irex Mines under which Irex can buy the ground within two years for $1.5-million.

Uranium Ridge Mines, in the Beaverlodge area of northern Saskatchewan, is planning to sink an incline winze from the adit to recover additional tonnage. The company is currently shipping limited tonnage of ore from its adit workings to the custom mill of Lorado Uranium Mines, Ltd., in this area.

A rapid speed-up of geological work and expansion of the Geological Survey of Canada was recommended in a brief to the Canadian Government, presented by the Royal Society of Canada, and the Geological Society of Canada.

In their submission, in late October, the two societies said Canada's Arctic islands must be developed in the interests of maintaining national sovereignty in this area, as well as for reasons of military strategy. Nor could needed transportation facilities be planned in the absence of geological knowledge of the areas to be served.

Lorado Uranium Mines, Ltd., in the Beaverlodge area, has completed conversion of its pyrite burning plant to elemental sulphur at a new rate of 90 tpd. Other projects include installation of a new boiler and construction of a 4,450-ft waterline from Lake Beaverlodge.

Milling rate has been averaging 600 tpd, stepped up to 650 tons on November 1. Further increases are being

planned for January 1959, to bring the mill up to 700 tpd, equal to production of $1.1-million per month. Potential mill capacity is 800 tons.

Canada's first potash mine went into production in November. Potash Co. of America's plant, 15 miles east of Saskatoon, began mining and milling following completion of a shaft to the 3,450-ft horizon. Driving from the shaft east and west is under-way.

The shaft sinking job itself and the equipping of the shaft for production have been unique in Canadian mining. Sinking took place through ground that had been previously frozen solid. It is believed to be the deepest shaft put down in this country through pre-frozen ground.

Pre-freezing was necessary because of unstable ground and the sand and water horizons above the potash. A series of deep holes was drilled in a circle around the center of the shaft. A second pipe was inserted in the outside casing of each hole. Refrigerant was pumped down the inner casing and removed through the space between casings until all ground to the shaft center was frozen.

Concrete pouring was complicated by pouring against walls at —5 deg F and by high sulphate content of soil. Refrigerant is still being pumped through the drill holes to ensure continuing ground stability.

The shaft is a 16-ft diameter opening completely concrete lined. It has no dividers, which was made possible by adoption of a system of rope guides, suspended in the head frame. Cages travel on two guides each. The main shaft opening serves for air exhaust, and fresh air is vented down the mine in an air duct fastened to steel hangars on the shaft wall. It consists of arc-shape panels of plastic treated fiber-glass forming a lens-shaped tube down the shaft wall. The 1¾-in. rope guides are of locked coil construction and are tensioned with dissimilar weights on each. Fixed guides are installed at both the skip loading and dumping points.

The ore beds underlie an area stretching east-west across almost the entire width of the province. The salt beds, a mixture of sodium and potassium chloride, are overlain by a cover of silt, sand, water, and limestone formation. At the company's shaft location, the main operating level has been established at 3,333 ft. The bed is practically flat, dipping gently to the south.

In the salt bed are the layers, richer in potash, that comprise the ore beds. The company expects to mine one bed, of 10 to 12 ft thickness. Grade is variable, the ore appearing coarsely crystalline, individual crystals ranging up to 1 in. Minor quantities of iron oxide permeate much of the bed.

The two drives now being extended are part of a 5-entry system driven with a width of 16 ft and full height of the ore bed. It is proposed to open as little ground as necessary within a 2,500-ft radius of the shaft, leaving a main shaft pillar 5,000 ft in diameter.

The drives are scheduled to advance at a rate to sustain milling operations at design capacity of 4,000 tpd. Ore is to be extracted using continuous mining machines, weighing 40 tons each, designed by the company. Broken ore is to be conveyed by a series of belts to storage bins near the shaft. These bins, in turn, feed to a conveyor leading to a 100-ton surge bin. Ore then moves through automatic controls on a conveyor actuated from the loading pocket.

MANITOBA

Maralgo Mines, Ltd., is awaiting winter freeze-up to undertake additional drilling, as well as a geophysical program, on its Hambone Lake nickel prospect in northern Manitoba. The last two drill holes, sunk in September and early October, encountered favorable nickel indications in the No. 2 zone, according to company president W. W. Dennis. This zone is located 800 ft south of the No. 1 zone where earlier drilling indicated a deposit estimated to contain 3.6-million tons grading 0.81% nickel. Grade in the No. 2 zone area has been placed at 1.10% nickel for an estimated 900,000 tons. The winter drilling is intended to follow up the indications on untested areas of the property.

The economic consultant firm of Arthur

Photo - Courtesy, United States Steel Corporation.

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Manitoba *(Continued)*

D. Little, Inc., Boston, has recommended to the government of the province of Manitoba that larger concessions be given to mining companies in the northern areas of the province. The report said that exclusive exploration permits for specific areas should be granted to companies, and government should accompany these permits with agreements on water and power rights, tax exemptions, guaranteed road construction, and long-term assistance for townsite and housing construction.

The report also urged government sponsorship of hydro power developments in the northern area to supplement plants being built or to be built by private enterprise.

NEWFOUNDLAND

Dominion Wabana Ore expects to turn out some 2.3-million tons in 1958 from its property on Bell Island. Most of this will go to the United Kingdom and West Germany. 1959 shipments are expected to equal this year's output. Production in 1957 was approximately 2.8-million tons, compared to 2.7-million tons in 1956 and 2.3-million in 1955.

NOVA SCOTIA

Magnet Cove Barium Corp. estimates that shipments in the 1959 fiscal year from its barite property at Pembroke, Hants County, will total some 180,000 tons. This would be an increase over the estimate of 165,000 for the fiscal year ended Oct. 31, 1958. Switch-over from open pit to underground operations is expected to be completed by the end of the current year. Levels have been established at 350, 520, 690 and 850 ft from the new 5-compartment 1,000-ft shaft. The company is a wholly-owned subsidiary of Dresser Industries, Houston, Texas.

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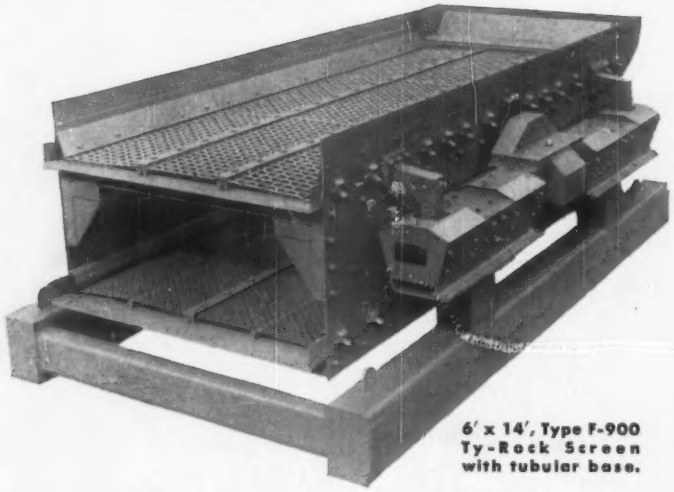

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ALBERTA

The possibility of "thawing out" the huge deposits of thick oil sticking to the Athabaska sands in northern Alberta, by setting off a nuclear blast, is moving a bit closer to reality.

Under recent consideration by the Canadian cabinet, the proposal was to be brought up by Mines Minister Camois in early November for a go-ahead to proceed with advanced planning.

If the cabinet approves, the next step would be to set up a committee of scientific experts from the Canadian department of mines, the Canadian national research council, and the Atomic Energy of Canada, Ltd.

The Athabaska sands, about 250 miles northeast of Edmonton and close to the Saskatchewan border, are estimated to hold 300-billion barrels of oil. Richfield Oil Corp., which originally interested the department of mines in the idea, made its preliminary investigations on the basis of a good deal of known information.

Many believe that principles used in petroleum refining would prevail in the effect of a nuclear blast on the oil sands. These are the heat and pressure forces required to separate gasoline and various weights of oil from the heavy crude. The result would be to melt the tar-like oil in the sands thin enough to flow out of the sand and collect in the cavity created by the explosion.

IN LATIN AMERICA

MEXICO

Charles A. Steen reported development of a "high grade", but to date relatively small, mercury deposit near Quertaro, about 75 miles north of Mexico City. Operator is Ranas, S.A., in which Mr. Steen is a major stockholder.

Steen said that the La Maravilla mine had been operated since the days of the Conquistadors, according to evidence found on the property. When Ranas took over about four years ago,

Mexico *(Continued)*

the miners were "climbing up and down chicken ladders" bringing ore to surface "by hauling pails on their shoulders", he said. A shaft has now been sunk to a depth of about 350 meters and hoisting equipment has been installed. Ranas S.A. is now installing a 20-ton rotary kiln for reduction of mercury ore. Average ore grade is better than 10%. Some assays have been as high as 30 and even 40% mercury.

Steen believes this property will be competitive even if world mercury prices take a tumble—which many in the Western Hemisphere freely predict with the end of purchasing by the U.S. government in 1959 from American and Mexican sources.

BRITISH GUIANA

A report from Georgetown said that the Minister of Natural Resources, Mr. Edward Beharry, hopes for quick action by the Colonial Office on an application from the Raraima Mining Co. Ltd., for exclusive permission to seek gold and diamonds in a part of the Echilebar River area, near the Brazilian border.

Meanwhile, Mr. Thoger Jungersen, vice president of the company, said that if an early decision is not forthcoming his company might move out.

Jungersen said the application to the British Guiana government was made in April at the same time the company had applied for exclusive rights in Panama. The company got the permission from Panama in four days.

FRENCH GUIANA

According to Jean-Jacques Gauthier, manager of the Consortium Miner Guyanais, tantalite mining in French Guiana, which was suspended owing to decreased demand, was resumed in June 1958.

The Consortium Miner Guyanais (COMIGU), a French corporation, has tantalite and columbite mining operations at Sursaut, on the Sinnamary River. This mine at one time supplied about 1,000 kilograms of tantalite a month to the U.S.; however, after the U.S. government ceased buying tantalite, the price declined and operations were eventually suspended.

CHILE

A high-grade iron deposit (said to be the largest ever uncovered in Chile) was recently discovered in Antofagasta province near the Bolivian border. Minera Santa Barbara (Isbrandtsen) has taken an option on the mine.

Paul H. Knowles and William Bowes, two AEC geologists, have been investigating radioactive mineral occurrences in Tarapaca, Antofagasta, and Coquimbo

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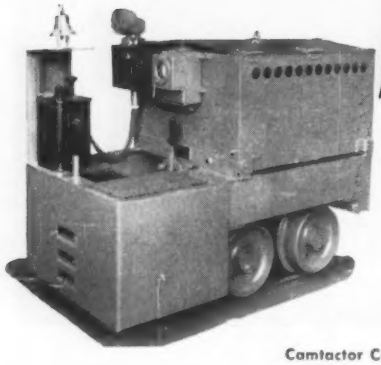

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Chile *(Continued)*

provinces. In the neighborhood of Tocopilla and Sierra Gordo (Antofagasta), favorable showings of radioactive minerals have been found.

Cie. Miniere du M'Zaita will soon begin operating its enlarged and modernized copper mill at El Cobre, Aconcagua province. Mill capacity has been increased from 600 to 1,100 metric tpd. An 8x10-ft rod mill and a ball mill will work in closed circuit with cyclones instead of mechanical classifiers.

IN AFRICA

Swaziland Iron Ore Development Corp. Ltd.—subsidiary of Anglo American—has been granted rights to prospect the Bomvu Ridge iron ore deposits in Swaziland in terms of a special prospecting license.

A record mineral output is likely in Southern Rhodesia, according to figures provided by the Department of Mines. The total value of minerals produced in the first seven months of this year was $42,725,000 as compared with $40,436,000 last year.

In the first six months of this year, manganese production from mines in the Luapula Province of Northern Rhodesia was more than three times as great as the entire production in 1957. A statement by the Mines Department recalls that production of this mineral began in the province in June 1953 and that 2,200 tons were produced in that year. Production for 1954 and 1955 were 3,218 tons and 3,696 tons.

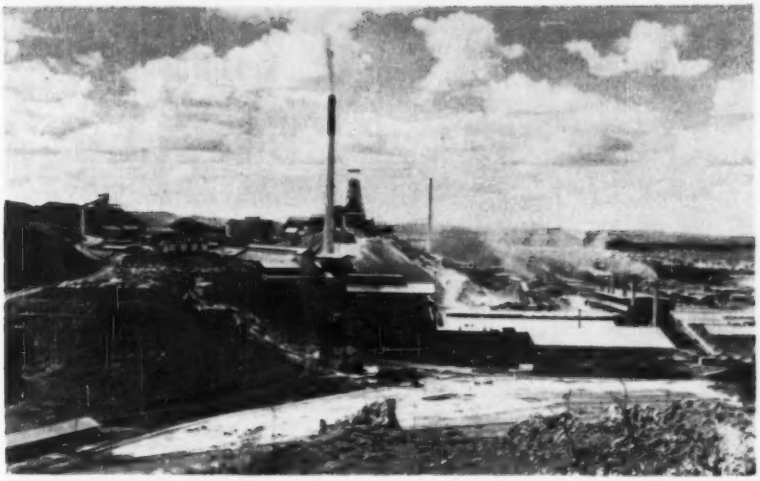
The Union's gold production reached a new peak in October. Total output was 1,560,726 oz, which topped the previous record by 58,230 oz.

The $54,534,360 gold value exceeded the September figure by more than $1,960,000.

As the available sources of payable ore at Consolidated Main Reef mine in the Witwatersrand area are diminishing, it has been found necessary to reduce the milling rate still further during the current year, the directors report. However, with better grade ore obtained from shaft pillars and the higher value of tonnage from the remaining ore reserves, an improvement is expected in both yield and revenue.

St. Helena gold mine in the Orange Free State will sink a new shaft to mine the upthrown ore block on the property's eastern side. The 22-ft dia shaft will be sunk to a depth of 4,100 ft and will eventually be deepened to 6,000 ft.

Ore is now being hoisted through the No. 3 shaft at West Driefontein on the Far West Rand, one of the richest mines in the Transvaal. This year's tonnage was 10,000 tons higher than last year. The continued application of mechanical screening improved the waste sorting rate and increased the yield, which



EVEN GREATER output is expected from Mt. Isa Mines Ltd.'s Queensland property.

Mt. Isa Prepares for Expansion Program

ACTION by the Australian government on the rehabilitation and improvement of the 603-mile railroad between Mt. Isa Mines Ltd. and Townsville, Queensland, Australia, is the last step to be taken toward an expansion program at the mine which will increase ore capacity from the present 6,000 tpd to 8,000, and see the construction of a 30,000 to 40,000-ton copper refinery at the seaport town. The latter will be constructed by June of next year. The mine is 52% owned by American Smelting & Refining Co.

Mt. Isa, which is mining 4.5% copper, 8.4% lead and 6.2% zinc, is taking copper ore from veins which run alongside the lead and zinc lodes which it began mining in the early 1930's. Current output, according to the *New York Times*, is running at about 40,000 long tons of copper per year, 50,000 tons of lead, 35,000 tons of zinc concentrates and 4-million oz silver.

The Australian government is understood to be negotiating for the necessary funds to replace track and improve the roadbed.

Africa *(Continued)*

showed an improvement of 0.347 dwt a ton.

Clyde Trading Co, South Africa, is operating a steel distribution center modelled along U.S. lines. The unit stores 60 different types of steel in 800 sizes, representative of the steel produced in the union.

A Benoni (East Rand) engineering firm, Wright Boag and Head Wrightson, is manufacturing 800 cars for the South African Railways at a cost of $2.8-million. The 23-ton hopper wagons are capable of carrying 40 tons of ore. Production is being stepped up to four units a day.

Aside from chrome, copper and tin, South African major mineral production values were up for the first 8 months of this year compared to the same period in 1957. Manganese showed one of the greatest gains—from $9.23-million last year to $9.76-million this year.

July mineral production in Southwest Africa showed some increase over that for the previous month. Output of lead-copper-zinc concentrates during July amounted to 17,556 tons and that of manganese to 10,787 tons.

Mining of emeralds from deposits discovered at the end of last year in Southern Rhodesia's Belingwe area will start on a pilot plant scale at the end of this month. Machinery, including two diesel electricity plants and equipment for extracting and washing the gem gravels from the workings, is now being installed. Mining officials have valued the claims at close to $14-million.

A recent development in the Tunisian mining industry is the reopening of a mercury mine at Djebel Arja, which, according to a government source, is producing mercury at the rate of 1 metric ton a month, with the expectation that this amount will be doubled by the end of 1958. The output of mercury in 1955 and 1956 was 5,727 and 755 kilograms, respectively. Production figures for 1957 were not reported.

IN AUSTRALIA

Large deposits of low-grade iron ore have been discovered in three separate areas in Australia. Preliminary diamond drilling by Rio Tinto (Australia) Pty. Ltd., on behalf of the Tasmanian Dept. of Mines led to the discovery of about 100-million tons of iron ore in the Savage River area, Tasmania. It was hoped that the ore could be improved by simple ore-dressing processes. Low-grade iron orebodies have also been discovered by Broken Hill Pty. Ltd. at

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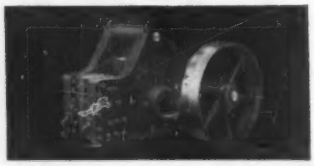

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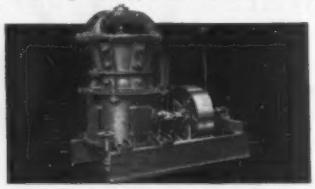
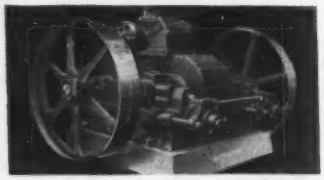
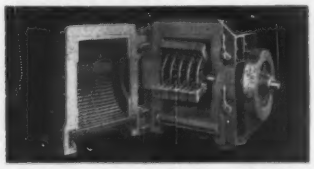


Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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Australia *(Continued)*

Roper Bar in the Northern Territory while drilling by the Government Bureau of Mineral Resources led to the discovery of similar deposits in the Constance Range area in Queensland.

American-controlled Mt. Isa Mines Ltd. will expand its Townsville copper refinery to provide for production of copper rod and wire. The company has ordered a new $11.3-million powerhouse to duplicate the new station being constructed and has ordered equipment for rolling copper rod. The electrolytic refinery would be operating next June. With the new plant, copper production could be pushed to 56,000 tpy (compared with the present rate of 40,000 tpy), while capacity will be in excess of 70,000 tpy.

The Industrial Chemistry Division of the Australian Commonwealth Scientific and Industrial Research Organization completed a four-year investigation of the possibility of replacing conventional smelting and refining by leaching and electrolysis after an initial roast in a fluidized bed reactor.

Project's objectives included:

1. to recover as much copper from the calcine as possible (97% recovery was the target)
2. to recover as much gold from the calcine as possible
3. to deposit the copper in a form sufficiently pure for direct melting and casting into marketable shapes
4. to deposit the copper in a massive coherent form for easy transportation and melting and not as powder or sponge
5. to use minimum power in copper recovery
6. to produce as little waste acid as possible to obviate the need to neutralize large quantities of acid with limestone to avoid pollution of adjacent water supplies.
7. to integrate various parts of the process into a workable whole.

Experiments were begun on a laboratory scale but were finally taken to semi-pilot-plant scale for the leaching, purification and electrolysis processes. The need for rapid analytical control led to the development of new procedures in polarography and spectrophotometry for eight different elements of significance in the process.

PHILIPPINES

After nearly two years of negotiations, an operating contract was signed between Pioneer Mining Corp. and Surigao Consolidated Mining Co., whereby the latter will develop and mine Pioneer's iron ore property in Zamboanga del Sur, northeast of the Samar Mining Co. Orebody's estimated output exceeds 3-million tons, averaging 64.37% iron, 0.21% sulphur, and no phosphorus. Exploration and development will start immediately.

Development work on the iron ore property of Samar Mining Co. at Sibuguey, Zamboanga, has indicated an estimated

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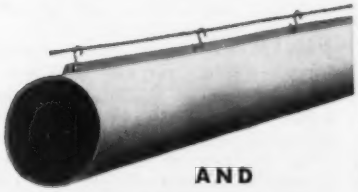

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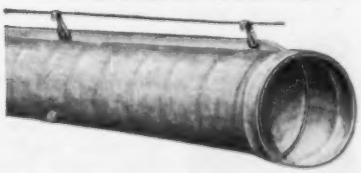

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Philippines *(Continued)*

7,588,000 tons of ore. Drillholes have outlined more than 20-million tons. Present plans call for a production rate of 600,000 to 700,000 tpy.

During September, the Toledo mill of Atlas Consolidated M. & D. Co. treated 331,141 tons of ore averaging 0.71% copper. From the 7,453 tons of 26.4% copper concentrates produced, an estimated 3,938,000 lb of copper and 909 oz gold were recovered. Total days of milling operations for the month were 27. Recent typhoons limited shipments of concentrates to Japan to less than 5,000 tons, valued at $833,000. However, estimated value of the September production was over $1-million, based on 25 ½c copper.

Lepanto Consolidated milled 39,500 tons in September, yielding 3,592 tons of concentrates estimated to contain 2,332,000 lb of copper and 3,936 oz of gold. Concentrates averaged 22.5% copper. Average content of ore treated was 3.12% copper and 0.133 oz gold per ton. All concentrates are shipped to Tacoma.

Marinduque Iron Mines milled 135,200 tons of ore at Sipalay, Negros Occidental, with concentrates estimated to yield 1,855,000 lb copper. This makes the mine the third largest copper producer in the Philippines, following Atlas and Lepanto.

In October, Surigao Consolidated Mining Co., Inc. milled a total of 10,370 tons of ore from its Siana, Mainit, Surigao mines. The company recovered 3,862.73 oz gold, 4,404.42 oz silver, and 159,361 lb lead. Based on average market price, the total production value amounted to $508,832.26.

IN EUROPE

ENGLAND

The flying phase of an airborne magnetometer survey of England's North Midlands and part of the Irish Sea is being completed by Canadian Aero Service Ltd., Ottawa, it was recently announced. The study is part of a program of regional geological and geophysical investigation being conducted by the Geological Survey and Museum, a research group of the Department of Scientific and Industrial Research, London.

BELGIUM

An agreement for cooperation in the peacetime uses of atomic energy between the U.S. and the six-nation European Atomic Energy Community (EURATOM) was recently signed in Brussels. The agreement has as its major objective the bringing into operation in the Community in the next five to seven years of approximately 1-million electrical kilowatts of nuclear power capacity, using reactor types developed in the U.S.

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Belgium (*Continued*)

The agreement, expected to come into force after Congress convenes in January 1959, contains the major objective of the U.S. and EURATOM on the joint nuclear power program, whose capital cost, exclusive of fuel, is expected to be about $350-million. These provisions include:

Financial guarantees by the U.S. of up to $90-million for a 10-year period with respect to the cost and integrity of the fuel elements required in the reactors;

Long-term assurance of an adequate nuclear fuel supply at prices equivalent to those offered to domestic U.S. industry;

Guarantee for a 10-year period of a market for the plutonium recovered from the power reactors in the program;

Long-term line of credits of up to $135-million to cover a portion of the capital costs of the power plants;

A long-term assurance by the U.S. that chemical reprocessing services will be available under terms comparable to those then available to U.S. industry.

An integral part of the program is a joint 10-year research and development project. During the first five years, the Community and the U.S. will each contribute up to $50-million to this program. Before the expiration of the first five years, the participants will determine the financial requirements for the remaining five years and will undertake to procure the necessary funds for the program.

FINLAND

The vanadium plant of Otanmaki, which began operating in 1956, installed additional equipment early in 1958, which will increase vanadium pentoxide production to between 900 and 1,000 tpy. In 1957, 469 tons of vanadium pentoxide was produced from the treatment of 88,000 tons of iron concentrate.

Obituaries (*from p 124*)

Russell C. Fish, 58, vice president, the M.A. Hanna Co., Cleveland, died Nov. 12 at his home in Grand Rapids, Minn. Mr. Fish also maintained a home at N. Moreland Blvd., Cleveland. After graduation from Case School of Applied Sciences with a B. S. degree from the School of Mining in 1922, he began his career with the M.A. Hanna Co. as a mining engineer in the Michigan district; in 1925 he became chief engineer. Mr. Fish was made general superintendent of the company's Minnesota mining operations in 1941 and in 1946 general manager of the company's entire mining operations. He was elected vice president of Hanna Coal & Ore Corp., operated by the M. A. Hanna Co., in 1956, and vice president of the latter in 1957. His professional memberships included the

Fish

Obituaries *(Continued)*

American Iron & Steel Institute, the AIME, and the Engineers Club of Northern Minnesota.

Corbin Marsh, 56, chief metallurgist for St. Louis Smelting & Refining division of National Lead Co., Fredericktown, Mo., died May 25. A graduate of the South Dakota School of Mines in 1925, Marsh was in the metallurgical department of St. Joseph Lead Co. for five years, and for two years with Bald Mountain Mining Co. before joining the American Cyanamid Co., where he was metallurgist for 12 years.

John A. Permont, 46, of Desloge, Mo., died Oct. 28. He was employed by St. Joseph Lead Co. at the No. 5 mine.

LETTERS

(The following letter, addressed to **Patrick L. Gooderham,** Public Relations officer, Anglo Transvaal Consolidated Investment Co. Ltd., Johannesburg, South Africa, is in reply to a letter published in last month's issue of *Engineering & Mining Journal,* p 126.)

We should like to express our regrets at having caused your organization any concern in connection with the use of reports on tests of the Trublast Rapid Stemming Plug at one of your locations. . . . The use of this material by *Engineering and Mining Journal* was in no way their responsibility. We supplied them with various data with our understanding that this material was public knowledge and available through the Chamber of Mines in the Union. We feel that the use of the material we supplied and the resulting article in no way should be construed by even the most casual reader as implying an endorsement or recommendation by Anglo Transvaal or any other group mentioned. We feel that this was a straightforward news reporting article which did not distort the facts or imply any endorsement.

We will certainly accede to your wishes and will not hereafter include any material or test results conducted by Anglo Transvaal without obtaining prior clearance from your office.

Charles A. Abbott, president
Charles Abbott and Associates
New York, New York

As an idle gold miner with a few caved-in holes in the ground, I would like to know why our senators try to tell us that if they raised the price of gold it would help Russia infiltrate more countries, while at the same time they deny us the right to hold gold and deny us the right of access to the market in the Near East and Bombay where Russia bootlegs her gold at as high as $61.50 per oz. For the last two years they (the Russians) have been increasing their production from 10- to 17-million oz per year.

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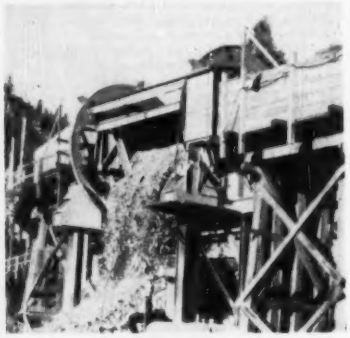

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MINE HOISTS: Nordberg 1250 H.P., double drums, both clutched, 10' x 10', 1¾" rope, 1200 FPM, forged steel drum shells, complete with all thoroughly modern electric. One Allis Chalmers single drum 10' x 10', 1¼" rope. Can furnish with either 700 or 400 H.P. motor, 3 phase, 60 cycle, 2200 volt. Offered with or without motor and controls. One single drum 84" dia., 60" face, 1⅜" rope, 32,000 lbs. pull, 250 FPM, 150 H.P., 2200 volts, post brakes, Lilly control, dial indicator. Condition like new. Other hoists sizes 100 H.P. to 2500 H.P.

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NEW DESIGNS IN CATERPILLAR EQUIPMENT AND PARTS DEPEND ON CREATIVE USE OF HIGHEST QUALITY STEEL

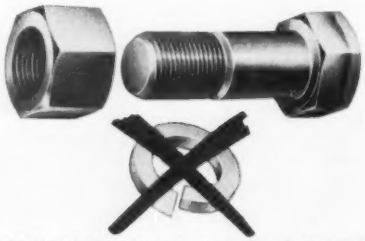
Example: Track hardware, made of stronger pre-tested steel and "Hi-Electro" hardened, stays tight without lock washers, often lasts through two sets of shoes

How much does it cost to pull a tractor off a job to tighten or replace track hardware? It costs plenty, in down time and in service time. That's why Caterpillar's new track hardware is such a good investment.

Caterpillar hardware normally stays tight without the use of lock washers throughout the service life of the first set of track shoes. And, exclusive "Hi-Electro" hardening of dome-shaped bolt heads often permits bolts to be used for a second set of shoes.

Most track hardware looks pretty much alike, but there's a big difference in quality. Steel, for instance. All steel for Caterpillar's new track bolts has a minimum tensile strength of 151,000 pounds per square inch, well above the SAE standard of 120,000-140,000.

The special steel accepted for track hardware is furnace-heated, quenched and tempered to toughen the entire bolt against breaking,



ELIMINATION of lock washer is feature of Caterpillar's new track hardware.

bending and the permanent stretching that leads to loosening of the nut.

Carbon, lost from the surface area in mill rolling and heat treating, is restored by Caterpillar with a carefully controlled, carbon-atmosphere process. Then threads are "rolled" into the bolt, curving the natural flow lines to follow the thread contours, producing threads that are highly resistant to stripping.

The large dome-shaped head receives an exclusive deep and even "Hi-Electro" hardening. This protects the hexagonal corners from mushrooming. Wrenches fit onto Cat bolts after many hundreds of hours of hard use.

This same quality of material, design and manufacture is found in *all* Caterpillar parts. And they're always available at your Caterpillar Dealer. See him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

SERVICE TIP

A torque wrench should always be used to tighten track hardware to factory-recommended torque values. Your Operating and Maintenance Instructions give exact values for each tractor model.

CATERPILLAR

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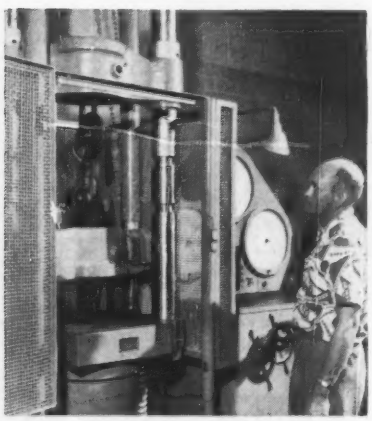
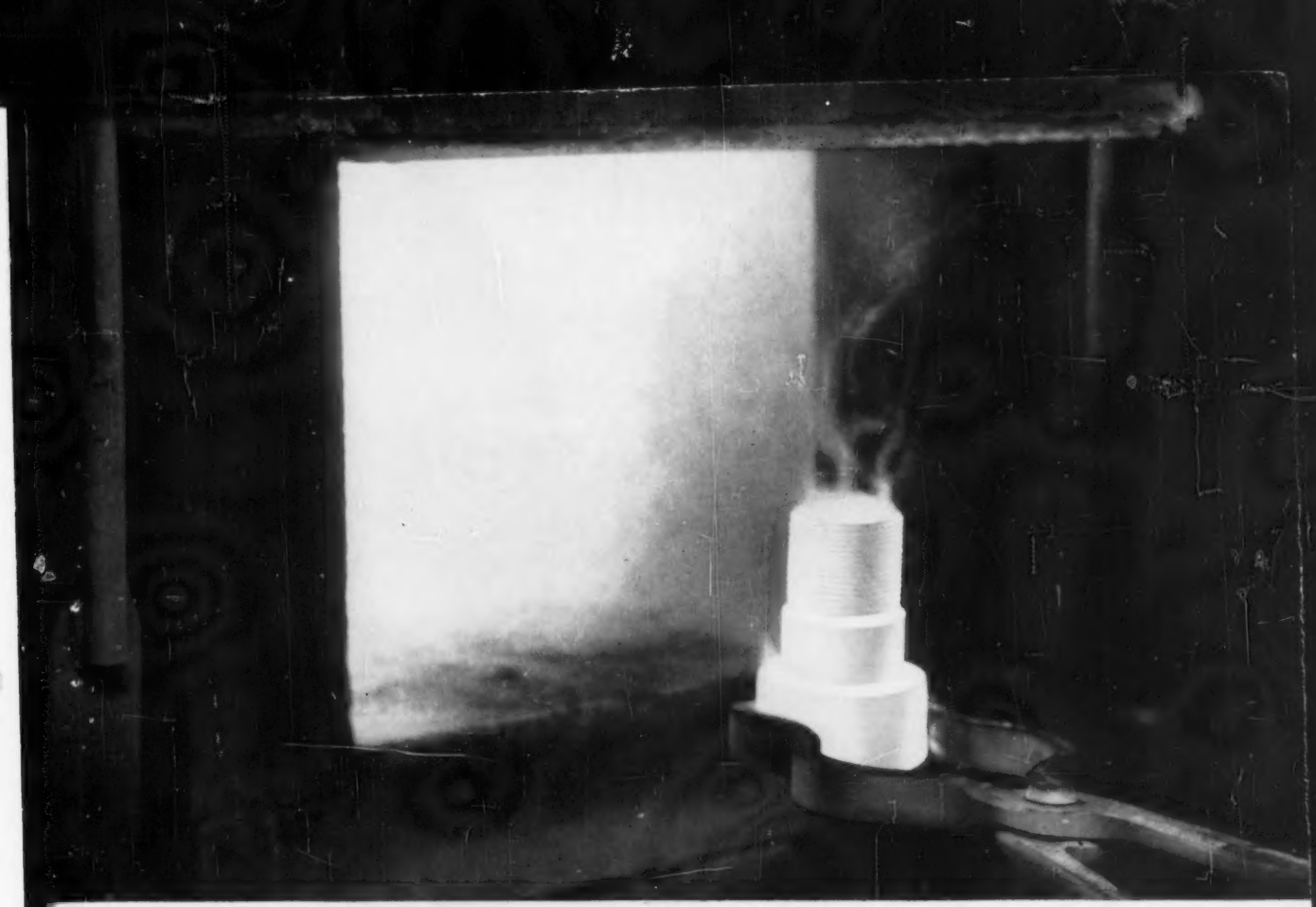


TENSILE STRENGTH of a bolt is tested in Caterpillar Laboratories. Each bolt is capable of supporting the full weight of the tractor for which it is designed.

DON KOPP, Master Mechanic, McCann & Co., Inc., Springfield, Ill.: "We're real boosters of genuine Cat parts, especially track parts. Other brands just don't last as long. When you buy Cat parts you know they are going to fit, last longer and give the best service because they are built to do the job by the people who built the machines."



Little Furnace
Makes Money for You

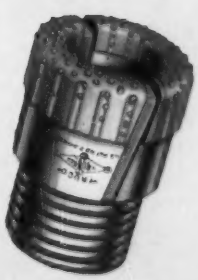
But for this little furnace you wouldn't be getting the irresistible cutting power or the footage or the diamond salvage that Truco Bits deliver today.

When our metallurgists developed our patented system for anchoring diamonds nearly twenty years ago, part of the secret lay in the sintering process by which diamonds were anchored in a solid, tough, metal bed which also developed a chemical bond with the diamonds and held them in a vise-like grip that was the wonder of the industry.

The sintering demanded precise control and these electric ovens were developed to sinter the powdered metal bed and bit blank into a solid amalgam without injuring the diamonds and without allowing them to move from their carefully set position, each with "best face to the work" for maximum cutting power.

Metals produced by this process cling to diamonds through toughest abrasive conditions and when the bit is finally pulled, there are more salvable diamonds there than you have any right to expect, except in a Truco.

That's one of the reasons why Truco Bits cost less. Try a Truco and see for yourself.



TRUCO DIAMOND BITS *by*

WHEEL TRUEING TOOL COMPANY

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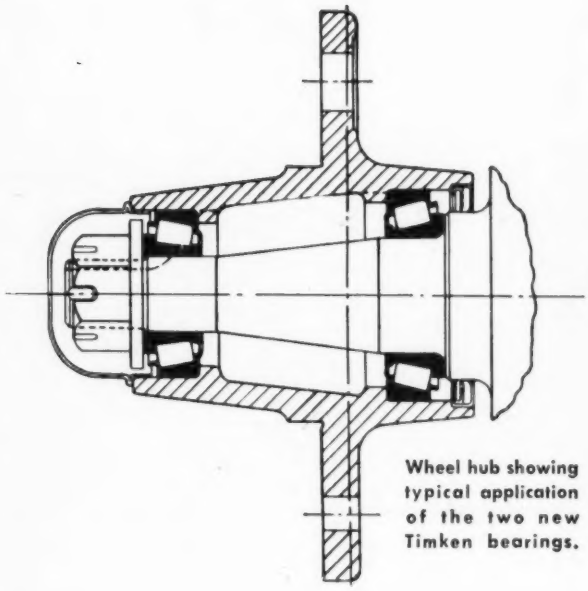
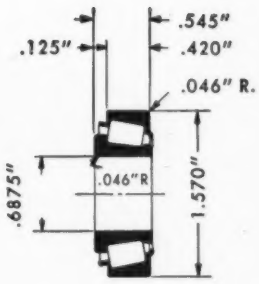
MEMBER Diamond Core Drill Manufacturers Association

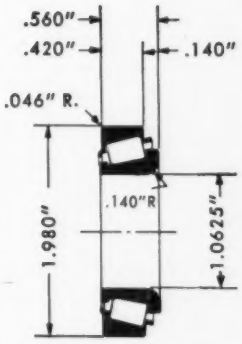
Two new, low-cost TIMKEN® bearings open new design opportunities



Wheel hub showing typical application of the two new Timken bearings.



LM 11749—LM 11710



L 44649—L 44610

WITH the two new small size Timken® bearings shown above, machine designers can now get the advantages of tapered roller bearings where they couldn't be used before. These new, smaller bearings pack high capacity in less space, and they're lower in cost. They permit more compact designs by keeping related parts smaller—provide additional savings in hub materials, seals, nuts and dust caps.

The inner bearing weighs about four oz. (.256 lb.). The outer bearing weighs less than three oz. (.181 lb.). They're the most economical single-row Timken bearings ever produced in these bore sizes. Developed originally for use in small automobiles, they can be used wherever there is a need for a low-cost bearing in this size range ($\frac{11}{16}$" and $1\frac{1}{16}$" bore). Diagram above at left shows them in a typical application on a wheel hub for a light car. Diagram above at right shows principal dimensions.

Like all Timken bearings, these new Timken tapered roller bearings are geometrically designed and precision-made to roll true. Their taper lets them take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity.

Our Sales Engineers will gladly give you complete data, help you design the new bearings into your machines. Timken bearings make any machine better, because Betterness rolls on Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best

TIMKEN

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TAPERED ROLLER BEARINGS ROLL THE LOAD